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## ORIGINAL MEMOIRS.

### TRACHEO-BRONCHOSCOPY.*

WITH REPORT OF CASES.

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UPPER bronchoscopy with the aid of the slide speculum is, in most instances, easy under general anæsthesia. The bronchoscope may be inserted at the first inspiratory movement, not only without difficulty, but without the slightest injury to the delicate mechanism of the larynx.

Under local anæsthesia upper bronchoscopy is, in a few patients, equally easy. In the majority of instances, however, the resistance and rigidity of the muscles is such that it is by no means easy fully to expose the laryngeal aperture for the insertion of the bronchoscope. In some of my work, I have encountered old cicatricial larynges where the cartilages of the larynx and trachea had been destroyed by purulent inflammation, and where the tissues surrounding the trachea and larynx were bound down and rigid with cicatricial tissue. In these cases, especially as there is no inspiratory widening of the glottic chink, it is very difficult to pass the bronchoscope under local anæsthesia by any of the methods heretofore in use. To overcome these difficulties I have added an extra handle to the slide speculum and a beveled end to the bronchoscope.

* Read before the College of Physicians, of Philadelphia, Nov. 20, 1907.

The handle affords a powerful leverage with which the base of the tongue and the tissues about the hyoid bone may be easily pulled forward out of the way and a good view of the larynx obtained under local anæsthesia. Endolaryngeal operative work may be done, and bronchoscopes may be passed by the aid of this instrument. One of its chief advantages is that no gag need be inserted until after the bronchoscope has passed the glottis. Gagging the mouth widely open hinders the drawing anteriorly of the tissues about the hyoid bone and the base of the tongue, by jamming the inferior maxilla down upon these structures.

To facilitate the passage of the tube in upper bronchoscopy I have been using recently a new bronchoscope, the distal end of which is cut off at an angle. The instrument otherwise is the same as those I have used for some years. The edge is thickened and rounded in the same manner to prevent injury to the mucosa. In use, the long end is directed forward toward the anterior commissure through which it can be passed with great ease. There is no need of waiting for an inspiratory movement, or for the subsidence of the glottic spasm. With this tube it is not necessary to expose the anterior commissure with the slide speculum as the point can be started between the posterior ends of the cords. There is no tendency for the tube mouth to catch over the arytenoids, instead of passing anteriorly to them. The slanting extremity has also the advantage that the point can be used in the bronchi as a retractor to draw aside spurs and orifices, thus greatly facilitating exploration.

CASE I.—*Piece of wood in bronchus four days. Removed by lower bronchoscopy.* Aged 5 years, referred to me by Dr. Adolph Lewin with the history of having aspirated the wooden plug out of a bamboo whistle four days before.

Dr. Russel H. Boggs reported that he was certain the foreign body was present from a physical examination of the chest, but that it did not show radiographically because of the insufficient density of a small piece of wood. The child was so cyanotic when brought upon the operating table at the Western Pennsylvania

Hospital that a general anesthetic was out of the question. In fact, the question of a preliminary tracheotomy arose in the author's mind and only his confidence in his preparedness instantly to stab the trachea induced an attempt at upper bronchoscopy. The head was held in the Boyce position by Dr. J. C. Markle. Upon attempting to introduce a 7 mm. bronchoscope, which proved to be too large, the breathing ceased. The tracheotomy was promptly done, and the 5 mm. bronchoscope was introduced. The bit of wood was found in the right bronchus and removed.

The tracheal wound was packed until it healed from the bottom. At the end of a week, Dr. H. E. Deers reported the wound healed and the child's condition perfect.

*Remarks.*—This case points a very valuable lesson. When a foreign body case comes with dyspnœa, no attempt should be made even to examine the throat without making preparations for a tracheotomy. These preparations need be but a sharp knife and a hemostat for a dilator, but these must be ready at hand for instant use, separate from all other instruments. If a leisurely tracheotomy with careful hemostasis is preferred, it certainly would be better to do the tracheotomy preliminarily under infiltration anæsthesia.

CASE II.—*Safety pin in trachea. Removed by upper tracheoscopy under local anesthesia.* Infant, aged 12 months, was brought to me at a public clinic in the Harper Hospital, Detroit, with a history of having swallowed a closed safety pin one month before. The stools had been carefully watched and the pin had not passed. There were no pulmonary symptoms whatever, and the physical examination of the chest was negative. Under chloroform anesthesia, I explored the esophagus and stomach thoroughly, and finding no signs of the pin, further examination was deferred until after Dr. P. M. Hickey made two radiographs (Fig. 1) which showed the pin in the trachea. With the assistance of Drs. Hickey, Shurly and Minor, I was able under local anesthesia to remove the pin (Fig. 2) by upper tracheoscopy in a rather unusual way.

The larynx of an infant will not admit a 7 mm. tube which was the smallest that I had with me in Detroit. I found, however,

that the mouth of this bronchoscope would enter the upper orifice of the larynx, fix the arytenoids and hold the glottis widely open. The view thus obtained is illustrated in Fig 3, which shows the cords at the sides, while posteriorly (dorsal decubitus) a large edematous swelling could be seen in the trachea below. The pin could not be seen, but I inserted a full-curved hook down into the trachea, and could feel the pin which I engaged in the hook so securely as to withdraw the pin from the trachea into and through the tube. The child made a complete recovery, without phonatory impairment. The radiograph is interesting as demonstrating that the pin was in the trachea. Had it been in the esophagus at the same level, it would have been in the lateral plane.

CASE III.—*Tack in bronchus four days. Removed by upper bronchoscopy under local anesthesia.* Mary M., aged 12 years, came with a history that four days before she had choked on a mouthful of tacks, one of which "went down." She had had paroxysms of coughing with expectoration of pink frothy mucus streaked with blood.

Under local anesthesia, the 7 mm. bronchoscope was introduced. The trachea and bronchi were found filled with pink frothy mucus in such large quantities that every landmark was hidden by it. The bronchoscope was removed and one with a drainage canal in its wall introduced and the aspirator started. Fully four ounces of mucus were pumped out during the examination.

A beautifully clear view of the mucosa was obtained. It was seen to be reddened and swollen, and in three places excoriations were visible. The tack (Fig. 4) was found point upward in the left inferior lobe bronchus and removed.

*Remarks.*—The chief points of interest in this case are the enormous quantity of mucus present, the advantage of the aspiratory bronchoscope in such a case, and the location of the tack in the left inferior lobe bronchus. The excoriations would indicate that the tack for a time had been thrown about by the coughing. One of the excoriations in the right bronchus would seem to indicate that the tack had been temporarily in the right side.

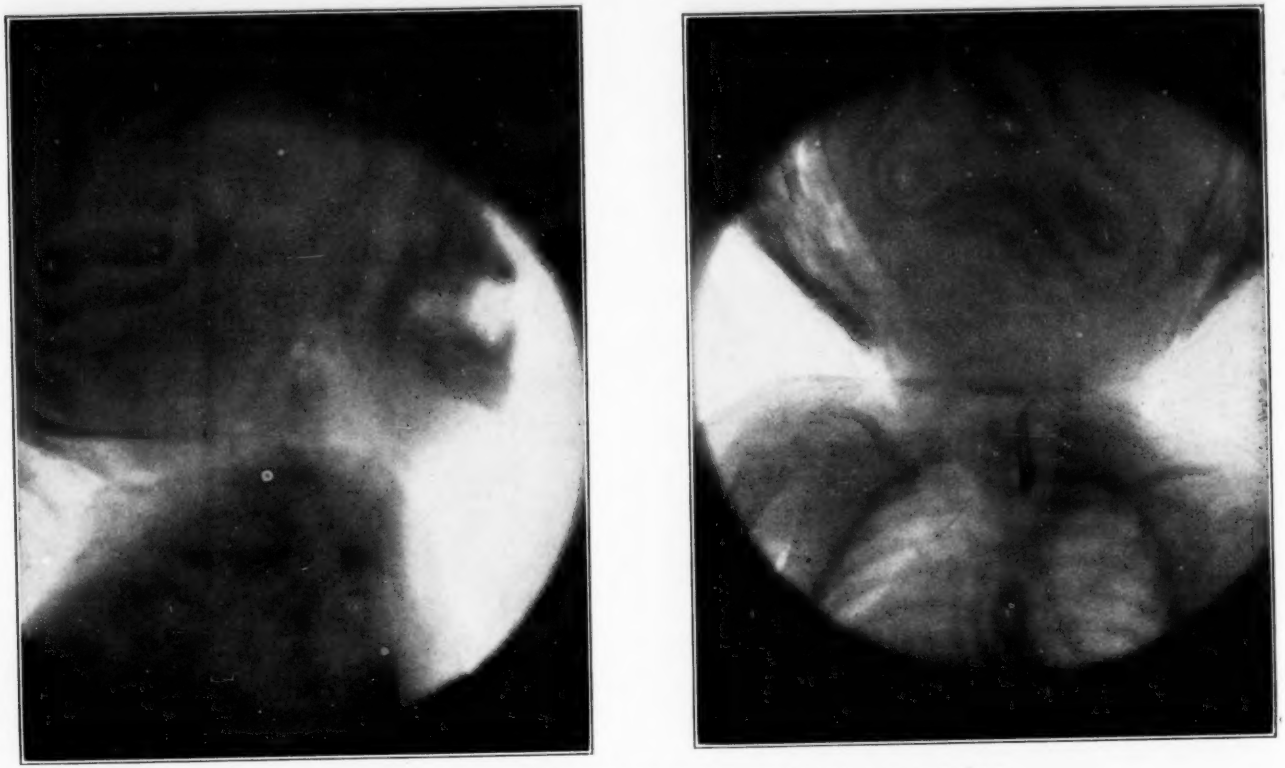
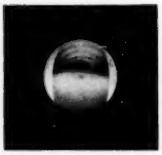


FIG. 1.—Two radiographs, showing a safety pin in the trachea of an infant one year of age.

FIG. 2.

Pin removed from the trachea of an infant one year old.

FIG. 3.



Endoscopic view down trachea, showing edema above the pin.

FIG. 4.

Tack from left bronchus of girl twelve years old.

CASE IV.—*Pebble removed from the right bronchus by upper bronchoscopy.* Martha M., aged 8 years, referred to me by Dr. Andrew Hunter of McKeesport. One week before while playing she had put a pebble into her mouth and started to run when the pebble "stuck in her throat so that she could not get it up." A physician who was called prior to Dr. Hunter had pushed the pebble downward as he supposed into the esophagus. The patient coughed violently for fifteen minutes expectorating some bloody mucus and she was hoarse for a time. Next day she was better, but ever since had had violent paroxysms of coughing excited by motion. No dyspnœa except immediately after coughing, no dysphagia, no fever, no pain until two days before, when it appeared in the centre of the chest. Physical examination showed a sonorous rale heard occasionally all over both sides. There was nothing in the physical signs to aid in locating a foreign body. No dyspnœa.

The patient was radiographed by Dr. George C. Johnston and the pebble located in the right bronchus (Fig. 5). She was admitted to the Eye and Ear Hospital and under chloroform I found, by upper bronchoscopy with a 7 mm. tube, a large grayish mass wedged in the right bronchus, the orifice of which was swollen and edematous above the mass. Forceps applied to the mass gave back a gritty sensation as the jaws slipped off. While working the respiratory current whistled through one of the lateral openings in the bronchoscope. Finally, a very thin jawed forceps was introduced so that the flattened blades could be pushed well down on the pebble between the latter and the swollen mucosa. The foreign body was then withdrawn from its firmly fixed position. The tug of the forceps could be felt, by the impulse transmitted to the bronchoscope, to pull the bronchus and trachea upward, so tightly was it imbedded in the bronchus.

It was too large to be withdrawn through the bronchoscope so the pebble, tube and forceps were all withdrawn together. When the pebble arrived at the glottis, it seemed too large to come through. It was stripped off from the grasp of the forceps and fell back into the trachea. The bronchoscope was again introduced when it was found that the smaller end of the pebble was in the orifice of the left bronchus, into which, however, it was too large to entirely enter. The orifice of the right bronchus could be seen partially closed by swollen mucosa, being dimin-

ished to not more than half its normal diameter. The pebble was again seized and this time was pulled through the glottis in which it was such a tight fit that considerable force was required.

The child was discharged well, as soon as the effects of the chloroform had disappeared.

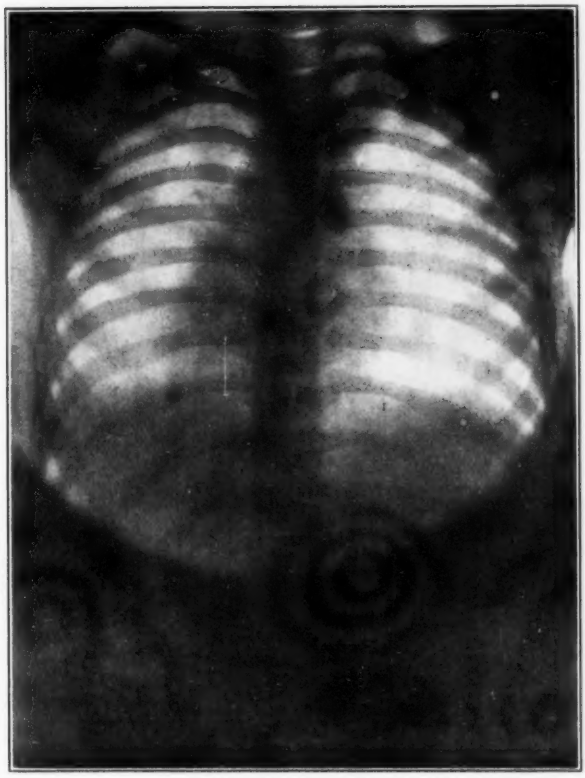
The pebble (Fig. 6) measured 7 x 9 x 17 mm., was dark brown in color, of rounded outline, and of very smooth surface. In situ, its greatest dimension corresponded to the axis of the bronchus.

*Remarks.*—This case illustrates one of the dangers of the crude old method of pushing down foreign bodies. The first attendant had felt the pebble with his finger but failing to get it up, he pushed it down, believing that it would pass safely through the gastro intestinal tract. Probably, it was in the glosso-epiglottic fossa. Certain it is that he pushed it through the glottis as if it were an intubation tube. Once through the glottis, the negative pressure of the violent inspiratory effort following the obstruction to breathing during the manipulation, produced a powerful negative pressure, which exerted upon so large, rounded, smooth and close-fitting a body, together with its density drove the pebble like a projectile into the right bronchus. In no other way is it possible to account for the tight impaction of the pebble in its position. Recent mucosal swelling would not do it, and the sojourn of the body was too short to permit of sufficient hyperplasia.

The size of the body indicated the elasticity of the bronchi. The diameter of the bronchi is changing every moment, but at the maximum normal dilatation the average diameter of the right main bronchus of children of seven years of age is 7 millimeters. Yet, here was a body whose cross section is 7 x 9 millimeters which entered the bronchus for a distance of about 2 centimeters.

This case also illustrates the necessity of having the lateral openings in the bronchoscope. When the tube mouth entered the right bronchus, the latter being occluded by the pebble, the patient would have been getting no air and the work could not have proceeded had not the tube had lateral openings, one of

FIG. 5.

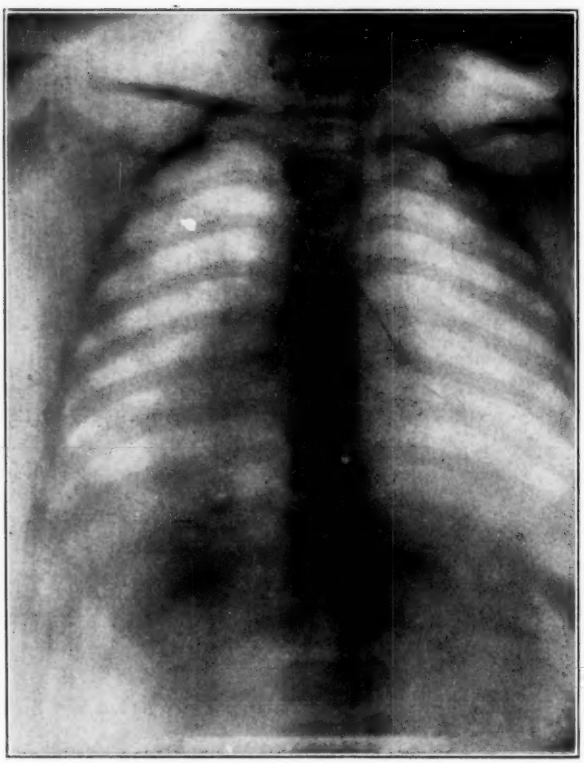


Radiograph of pebble in right bronchus of a girl eight years old.

FIG. 6.

Pebble removed from right bronchus.

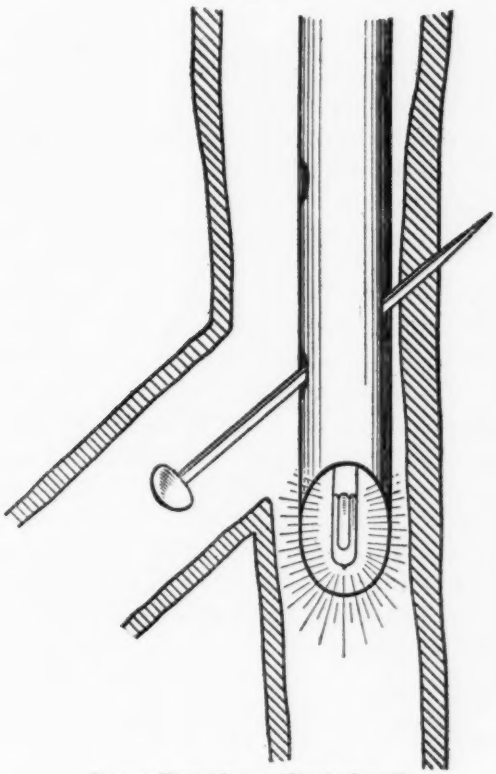
FIG. 7.



CASE V.—Radiograph, showing pin in right bronchus.

which corresponded to the orifice of the right bronchus. Had it not exactly corresponded the result would have been the same, as the bronchoscope used did not, and should not fit tightly in the trachea, so that there was abundant room for air to pass up the trachea until a lateral opening was reached.

FIG. 8.



Schema illustrating accident in Case V.

CASE V.—*Glass headed steel pin in right bronchus. Removed by upper bronchoscopy.* Henry M., aged 4, was referred to me by Dr. A. D. Housted. The child had aspirated a pin five days previously followed by severe coughing attacks. A radiograph (Fig. 7) by Dr. George C. Johnston showed the pin to be in right bronchus head downward.

At the Eye and Ear Hospital the child was chloroformed by

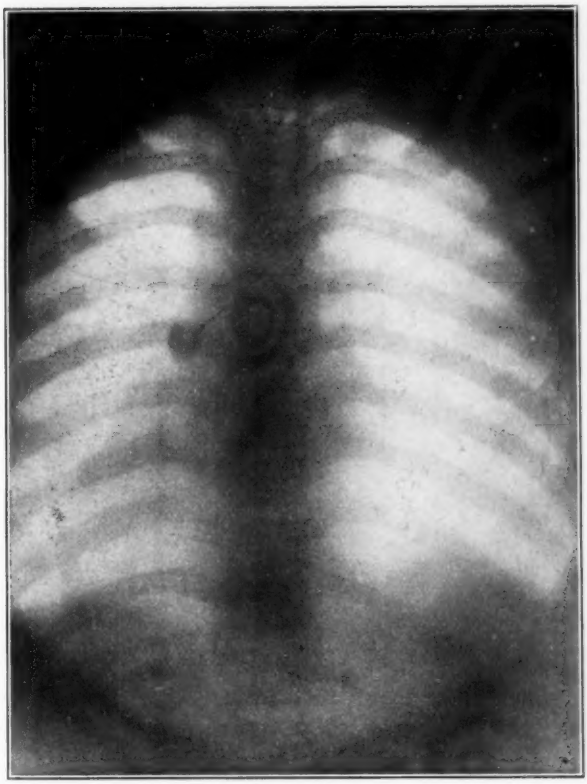
Dr. Edith Waldie, and with Dr. L. C. Manchester holding the head in the Boyce position I removed the pin by upper bronchoscopy. A peculiar accident rendered the removal exceedingly difficult. I was using at the time a bronchoscope in which as I discovered afterward the holes were too near the lower end. When the bronchoscope entered the right bronchus the pin was seen, but just then the patient coughed and the bronchoscope was slightly withdrawn and cocain solution applied to the bronchial mucosa. The bronchoscope was again passed downward and when the opening of the upper lobe bronchus was reached a severe coughing effort forced the pin upward through the hole in one side of the bronchoscope and out through a hole in the other side, and into the bronchial wall, thus spiking the bronchoscope in position so that it could not be withdrawn (Fig. 8). The pin could be plainly seen, across the lumen of the tube, but it could not be removed with forceps, nor could it be pushed downward. Pulling on the bronchoscope showed such rigid fixation that violent withdrawal was not to be thought of. After twenty minutes of fruitless efforts to dislodge the pin I resolved to break it, as the safest expedient. This was readily done by pushing downward on the pin while gripped in the forceps. The grip slipped slightly until the pin came against the canula of the forceps, when of course, any desired amount of thrust could be exerted, counter-pressure being exerted by the bronchoscope which I held rigidly against the upper teeth. The pin broke readily and two portions of it were withdrawn (Fig. 9), but the third, the point probably about 5 mm. in length was lost. Having previously broken my glasses my one eye had become temporarily useless from the mydriasis due to the cocaine coughed into it. Dr. Waldie made a careful search and, finding nothing, I feel certain that the small point was lost in the secretions withdrawn with the tube. The child has been perfectly well ever since and has had no cough whatever.

*Remarks.*—This case demonstrates the necessity of having the lateral openings located at some little distance from the end. It also demonstrates the necessity of the wearing of glasses, to prevent coughing of cocain-laden secretions into the eye. Indeed, the necessity exists whether the secretions contain cocain or not, for apart from infective risks, it is annoying and cer-

FIG. 9.

CASE V.—Pin removed from right bronchus of a child four years of age.

FIG. 10.



Radiograph showing stickpin in left bronchus. Pin was removed by bronchoscopy through natural passages.

FIG. 11.

Pin removed from left bronchus by bronchoscopy.

tainly interferes with good work, to say the least, to have the eye spattered with coughed-out secretions. An unsterile nurse should be detailed to keep the glasses cleaned, and this will be greatly facilitated if two pairs of glasses are at hand.

CASE VI.—*Stick pin in the left bronchus. Removed by upper bronchoscopy.* Samuel B., aged 15 years, brought to me by Dr. M. V. Leof, of Philadelphia, at the suggestion of Dr. E. B. Gleason.

About a week before he had choked on a scarf pin, which escaped down his throat. This was followed by cough and "brassy" tasting expectoration. Cough had been very much less in the last two days. There was no pain in the chest. A radiograph by Dr. Wilbird, of Philadelphia, showed the pin head downward in the left bronchus. An eminent surgeon who saw the patient advised against thoracotomy.

Dr. Gleason, who next saw the case, gave a favorable prognosis and advised bringing the case to me. A radiograph (Fig. 10) by Dr. George C. Johnston demonstrated the pin in the same position as before. Patient coughed every time he was asked to hold his breath for radiography. Physical examination by Dr. John W. Boyce revealed harsh breathing over left side, scarcely amounting to rales. On forced breathing, movement was greater on right side, which, unless discovered, would have been misleading as to auscultatory findings. Resonance possibly a trifle better on right side, but no great changes in percussion note.

At the Eye and Ear Hospital the boy was skilfully chloroformed by Dr. W. W. Jones, the head was held in the Boyce position by Dr. John W. Boyce, and, assisted by Dr. Ellen J. Patterson and Dr. Edith Waldie, I removed the pin (Fig. 11) by upper bronchoscopy. The task was a difficult one from the fact that the point of the pin had penetrated the right tracheal wall and was thus fixed at both ends. The violent coughing efforts excited by the presence of the foreign body had worked the pin downward by the ratchet-like action of the pin itself. The head lay in the left inferior lobe bronchus at the orifice of the upper lobe bronchus. Traction on the pin with the forceps revealed the fact that the point was firmly fixed in the tracheal wall which

had been penetrated to a depth sufficient to cover the taper of the point; therefore, seven or more millimeters. Upon attempting to push the intruder downward I found that the limit of elasticity of the bronchus had been already reached by the ratchet-like action of the pin in working itself downward. Furthermore, violent coughing was set up by the pressure of the head of the pin upon the mucosal area where it lay, deep down in the left bronchus beyond the reach of safe cocainization. Only drenching the bronchus could have gotten cocain solution below the head. This I deemed unsafe. I finally succeeded in pushing the trachea to the right, off the point with the tip of the tube while making counter pressure with the forceps. After freeing the point, it was grasped in the forceps, when considerable traction was found to be necessary to dislodge the head, which was evidently buried in the swollen mucosa. The pin was pulled up until the head engaged against the tube, then pin, forceps and bronchoscope were brought up together. Considerable resistance was encountered as the head of the pin reached the glottis, but it was pulled through without the forceps losing their grip.

The boy left for his home in Philadelphia the same evening.

Neither morphin or codein was used in this case, and the cocain solution was of only 10 per cent. strength.

*Remarks.*—For reasons elsewhere mentioned I am not sure that the avoidance of morphin lessened the risk. A slight excitement after coming out of the influence of chloroform would seem to indicate the wisdom of the use of no stronger than a 10 per cent. solution of cocain. Another point of interest is the large size of the intruder. Even allowing for its weight, it could not have simply dropped to the depth where found in the left bronchus. It must have been pushed downward into the bronchus, or more accurately, the bronchus must have been pushed up over the head in coughing, the point striking against a lower and still lower portion of the right tracheal wall, until the head came to a final stop owing to the narrowing below the giving off of the upper lobe bronchus. Then the heaving evidently forced the point of the pin into the right tracheal wall. This heaving I noticed with some misgivings, when working with the pin. No one who has not

witnessed it bronchoscopically can have any idea of the amount of spontaneous movement of the tracheo-bronchial tree. The bronchi diminish in size, and move longitudinally to an incredible degree in coughing. In later cases I have found heroin hypodermically, preliminary to anesthesia the best antibechic.

Another valuable lesson to be learned from this case is the usefulness of the lip of the bronchoscope. I devised this lip originally to facilitate introduction of the tube mouth through the glottis without waiting for the inspiratory abductive excursion of the cords, and without risk of abrasion of the laryngeal mucosa. Its usefulness as a spatula to press aside spurs and folds was demonstrated in previous cases, but in this case its usefulness in extricating the buried point of a foreign body by pushing the tissues off the point was demonstrated. The tip cannot be seen when looking through the bronchoscope, but the side on which it is, is known by the position of the handle, this being on the same side of the tube.

Including the cases herewith recorded, the author has done 10 bronchoscopies for foreign bodies in the bronchi, in which the foreign body was present. Of these, the foreign body was removed in 7, not removed in 3. Eight were upper and 2 were lower bronchoscopies. Of tracheoscopies for foreign bodies, the author has had 7 in which a foreign body was present. Of these, 3 were dyspnœic on admission and required tracheotomy, and 2 not dyspnœic and 2 dyspnœic were upper tracheoscopies.

In all of the 7, the intruder was removed.

Recapitulating, there were 17 tracheo-bronchoscopies for foreign bodies in the air passages below the larynx, omitting cases in which a foreign body was absent. Of the 17 cases, the intruder was removed in 14, not removed in 3. Not only was there no mortality, but there was no reaction in any case.

# TRICHINOUS INFECTION OF A CARCINOMA OF THE LIP.*

BY EDMUND A. BABLER, M.D.,

OF ST. LOUIS, MO.,

Associate Surgeon to the St. Louis Skin and Cancer Hospital; Assistant in Surgery in the Medical Department of Washington University.

The finding of trichinæ in carcinomatous tissues is quite rare. In fact, a careful review of the available literature shows that only two such instances have been reported. In one [1] of these cases, the parasites were found in a carcinomatous lip, and in the other,[2] in a carcinomatous breast. In both instances the trichinæ were found by the pathologist while examining the tissues for evidence of carcinoma. A private letter [3] from the Surgeon General's Library corroborates the assertion that the case herein reported is the second to be recorded in which trichinæ were found in a carcinomatous lip. It is quite possible, however, that the association of trichiniasis and carcinoma is of not infrequent occurrence. Whether or not the presence of trichinæ in the living tissues favors development of carcinoma, remains an open question.

The case herein reported is of interest not only because of the finding of trichinæ in the carcinomatous lip, but also in demonstrating the danger of permitting apparently harmless warts to grow. In the future we will publish a report of eighteen cases of malignant disease treated at the St. Louis Skin and Cancer Hospital in which the primary growth was a wart or a mole.

CASE.—Mr. G. S., white, laborer aged 62, was admitted to the surgical service of the St. Louis Skin and Cancer Hospital, October 14, 1907, and gave the following history:

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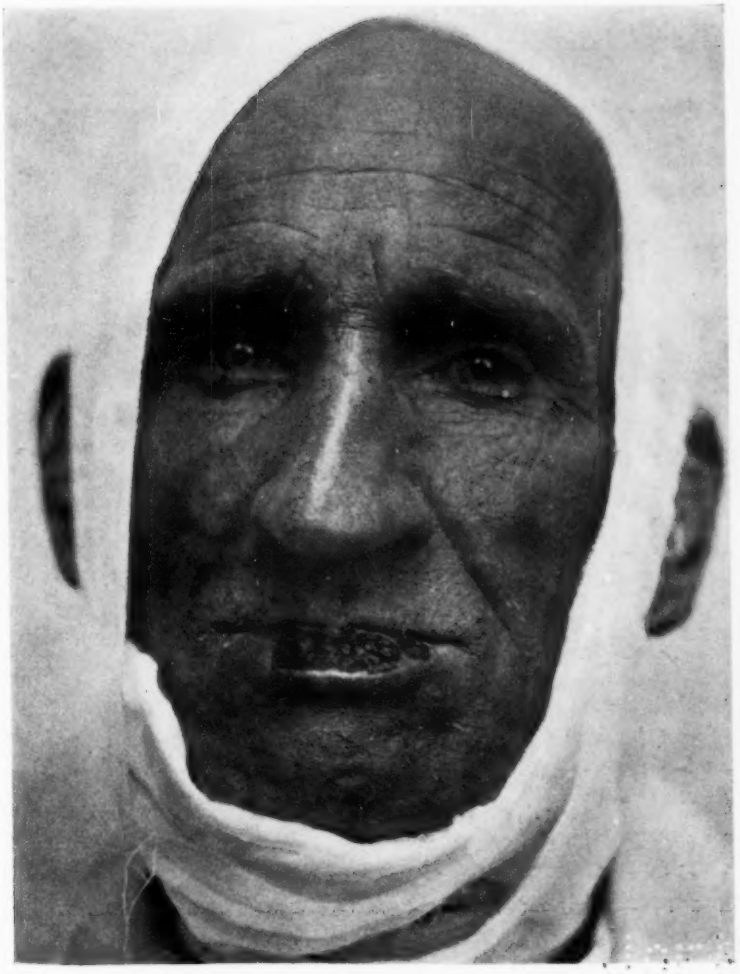
* From the St. Louis Skin and Cancer Hospital, Service of Dr. F. J. Lutz.

[1] Stewart, Modern Medicine, 1899, Vol. 8, p. 53.

[2] Timm, Virchow's Archives, 1864, Vol. 30, p. 447.

[3] Courtesy of Dr. Fletcher of the Surgeon General's Library.

FIG. 1.



Dr. Babler's case of trichiniasis carcinoma of the lower lip.

FIG. 2.

Micrograph of section showing trichinae (aa) among the tissue of a carcinoma of the lip.

*Family history.*—No history of malignancy or tuberculosis in family.

*Previous history.*—Usual diseases of childhood. Smokes and chews tobacco; smokes more or less constantly; drinks moderately. About twenty-five years ago he noted a small wart on his lower lip, near the middle, but since it caused him no inconvenience, he gave it but passing notice. About a month or two ago he noticed that the wart was rapidly becoming larger and that his lower lip was swollen. Pain has been slight, but the dribbling of saliva caused great discomfort. Denies lues. Has not lost flesh of late although he eats at irregular hours and poorly cooked food. Of late the warty-like growth has been more or less constantly covered with a scale or scab.

*Present trouble.*—Comes to hospital on account of the increasing size of the warty-like growth on lower lip and the swelling of the latter.

Examination shows patient well nourished and in apparent good health except for the growth on and swollen condition of his lower lip (Fig. 1). The entire lower lip is swollen; near the centre of the free margin of the lip is a scaly growth presenting the characteristics of an epithelioma. The swollen condition of the lip does *not appear to be due to the epitheliomatous growth only.* The submental and the submaxillary glands are not palpably enlarged.

Having been so frequently impressed with the fact that a wart may suddenly show malignant changes, and appreciating the importance of early excision, the patient was admitted to have the growth removed. One day later, the entire lower lip was excised and the submental glands removed. The silkworm gut sutures were removed on the fifth day. Union was primary. The pathologic report follows:

*Pathologic Report.*—Laboratory No. 959.—The epithelium covering the surface of the specimen suddenly changes from the normal to an irregular layer of great thickness. In this portion, long finger-like projections of cells extend deep into the underlying tissues. Throughout the greater part of the growth, the cell nests have penetrated down into the muscular tissues and have brought about an atrophy of the muscle fibres. Along the advancing periphery of the new growth there is a very marked infiltration of lymphocytes and plasma cells. The cells found in the nests are quite large and polygonal, and contain a large round or oval vesicular nucleus. Many of them show varying

degrees of keratin formation, and typical epithelial pearls are very numerous. The cells on the surface of the growth show marked keratin formation and parakeratosis. On the mucous side of the specimen is found a small salivary gland. On the skin side are seen numerous hair follicles, sebaceous and sweat glands. Lying deeper within the muscular tissues are two bodies, circular in shape (see Fig. 2) with a surrounding rim of homogenous substance that stains with eosin. This ring encloses cells and nuclei enclosed within a definite membrane. In between these bodies is a small amount of a granular pink staining material. External to the capsule is a slight amount of round cell infiltration. These masses lie embodied in the muscular tissue, and the adjacent muscle fibres have been flattened in varying degrees. The appearance is that of an encapsulated trichina. These bodies lie quite close to quite a large artery.

Before concluding I want to thank Dr. Lutz for permission of reporting the case, Dr. Guthrie McConnell for the pathologic report, and Dr. Mook for the photograph.

# LUDWIG'S ANGINA.

AN ANATOMICAL, CLINICAL AND STATISTICAL STUDY.*

BY T. TURNER THOMAS, M.D.,

OF PHILADELPHIA,

Instructor in Surgery in the University of Pennsylvania; Assistant Surgeon to the University and the Philadelphia General Hospitals.

(Part II. Continued from page 183.)

A cellulitis localized to the submaxillary region, regardless of the kind of infection, in the writer's opinion, is not a Ludwig's Angina; but becomes one as soon as the process invades the floor of the mouth and the pharynx. Poulsen as we have seen, assumed that the invasion occurred through the pharyngeal wall. Delorme merely located the phlegmon in the sublingual tissues without attempting to trace its further progress, while Semon simply stated that extension occurred from the throat to the neck, or from the neck to the throat, without reference to the path of progress. Davis seems to agree with Semon, but adds that it spreads along the connective tissue by direct continuity.

The writer hopes to demonstrate how a cellulitis about the submaxillary salivary gland, may progress along planes of connective tissue to the mouth and pharynx, and why such extension so quickly invades the region of the larynx. Leterrier said that not enough attention had been paid to the anatomy of the mouth in connection with Ludwig's Angina, and he is the only author so far as the writer can learn, who has paid any attention to it. He drew his conclusions from a study of the topographical anatomy of Tillaux and the demonstrations of Sebileau. The writer has made a special study of this subject by dissections of this region.

The anatomical work was done in the department of Applied Anatomy of the University of Pennsylvania, and the

* Read before the Philadelphia Academy of Surgery, November 4, 1907.

writer wishes, here, to thank Professor Gwilym G. Davis, the department head, for his kindness in furnishing all the necessary facilities. To Professor Geo. A. Piersol the writer is indebted for the freedom of his anatomical department and his specimens, and to Mr. Erwin F. Faber for valuable assistance in emphasizing in the illustrations those points which are essential to an understanding of the text. This opportunity is taken to acknowledge also the writer's indebtedness to Professor J. William White for kindly criticism and valuable suggestions.

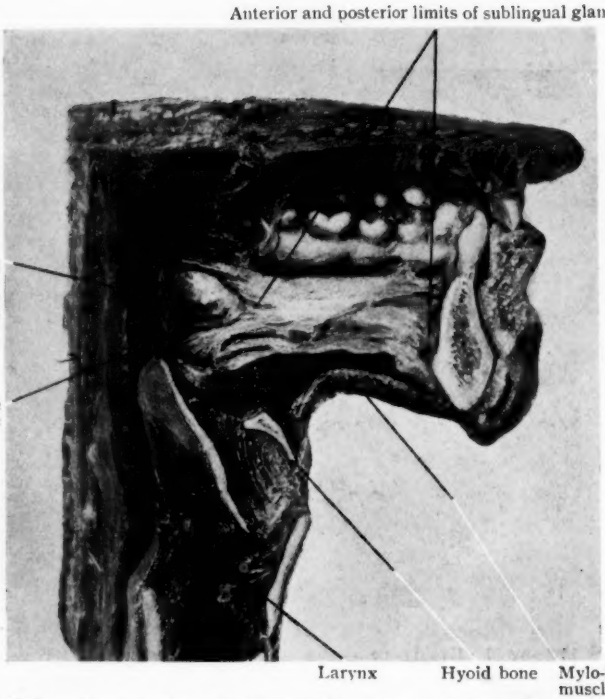
Few portions of the body are so imperfectly dissected by the average student as is this region. As a result few physicians can comprehend with any detail the anatomical relations of the floor of the mouth in its relation to the pharynx and larynx. Special sections were necessary to expose the tongue, the pharynx and the larynx, and the adjacent parts of the neck in the same specimen. By a transverse section of the head above the upper surface of the tongue, and a vertical section through the pharynx, of the lower part removed by the transverse section (see figure I.), a part of the head was obtained which gave a free exposure of the tongue from above and of the posterior part of the tongue, the anterior wall of the pharynx, and the complete larynx. The parts involved in Ludwig's Angina were thus preserved in this portion of the head and could be dissected from above and below. The facts brought out by these dissections taken in conjunction with the clinical facts repeatedly demonstrated by the recorded cases and with the autopsy reports, seem to clear up many of the obscure points associated with this condition. Only those autopsies which have shown the condition of the larynx have been considered.

*Anatomy.*—The muscular floor of the mouth is formed by the two mylohyoid muscles which fuse with each other at the anterior median raphe. This muscular diaphragm separating the mouth from the neck is a complete one from the posterior edge of one mylohyoid muscle to that of the other and is a comparatively strong one. There are no openings

FIG. 1.

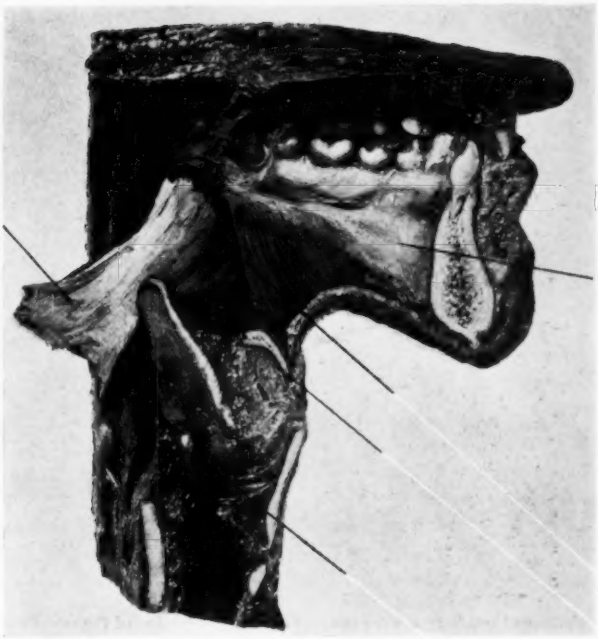
Median, sagittal section of that part of face and neck involved in Ludwig's Angina. Horizontal section about $\frac{1}{16}$ inch below highest part of roof of mouth. Tongue, somewhat shrunken from loss of body fluid, almost fills mouth.

FIG. 2.



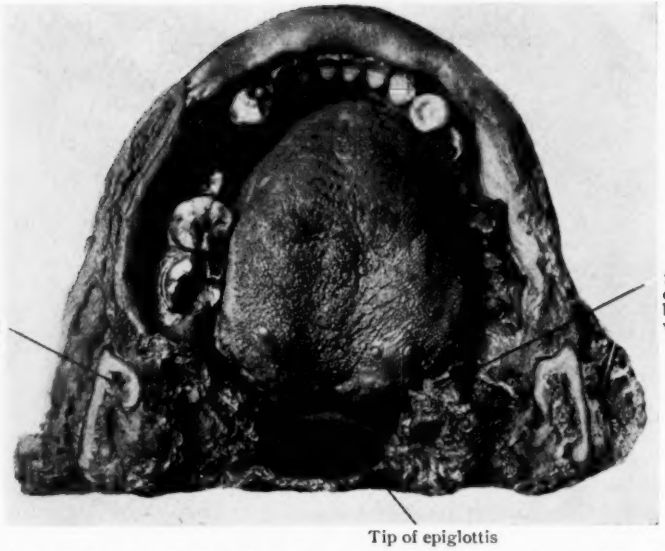

Half of specimen opposite to that illustrated in Fig. 1. Half of tongue removed, to show continuity of cellular tissue about the submaxillary and sublingual salivary glands, and proximity of deep portion of submaxillary gland to larynx.

FIG. 3.



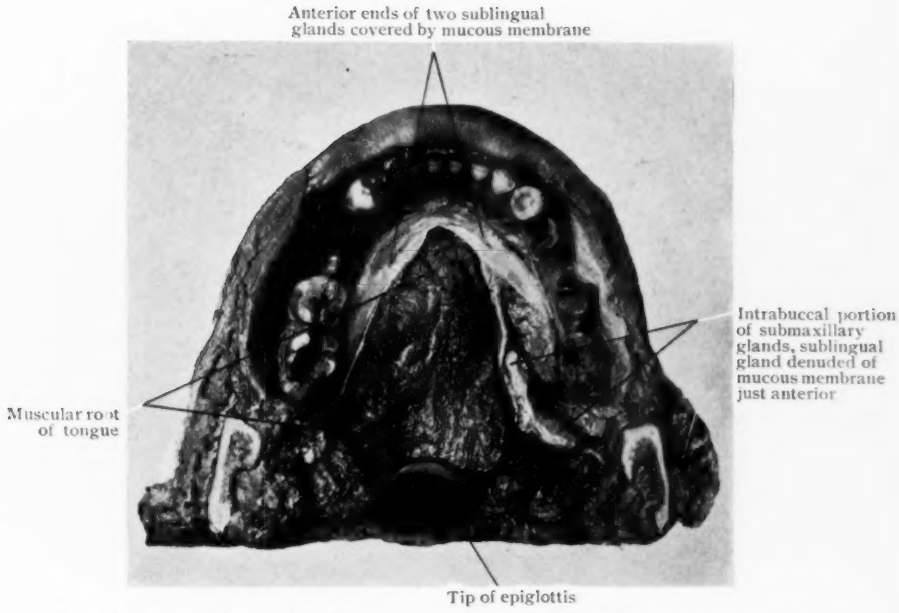

Same specimen as illustrated in Fig. 2. Sublingual gland and deep portion of submaxillary turned backwards, showing from within the mouth the anterior boundary of the opening in the muscular bucco-pharyngeal wall.

FIG. 4



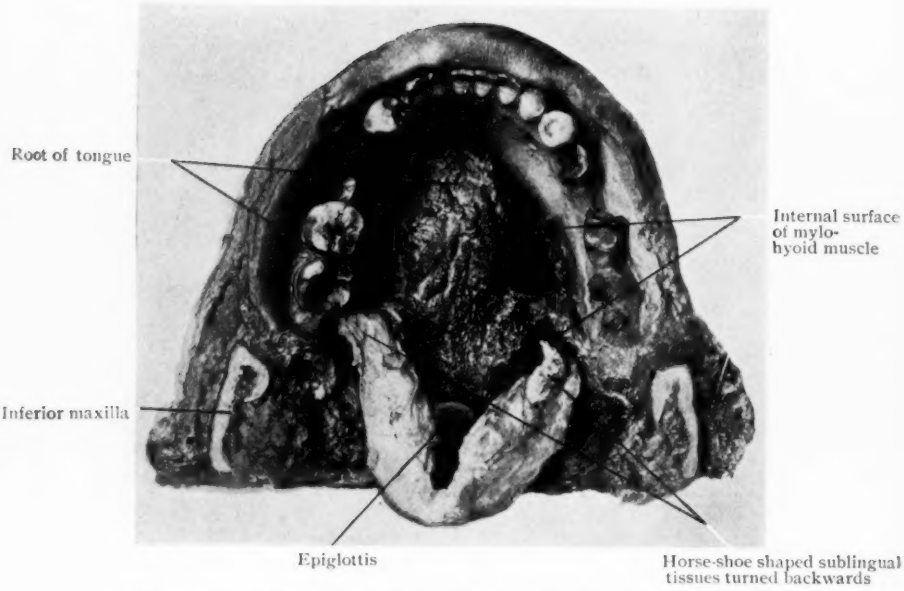

Upper surface of specimen similar to that formed by the union of the two, illustrated in Figs. 1, 2 and 3. Tongue crowds teeth laterally. It is loosely attached and has dropped backwards, slightly.

FIG. 5.


Anterior ends of two sublingual glands covered by mucous membrane
Intrabuccal portion of submaxillary glands, sublingual gland denuded of mucous membrane just anterior
Muscular root of tongue
Tip of epiglottis

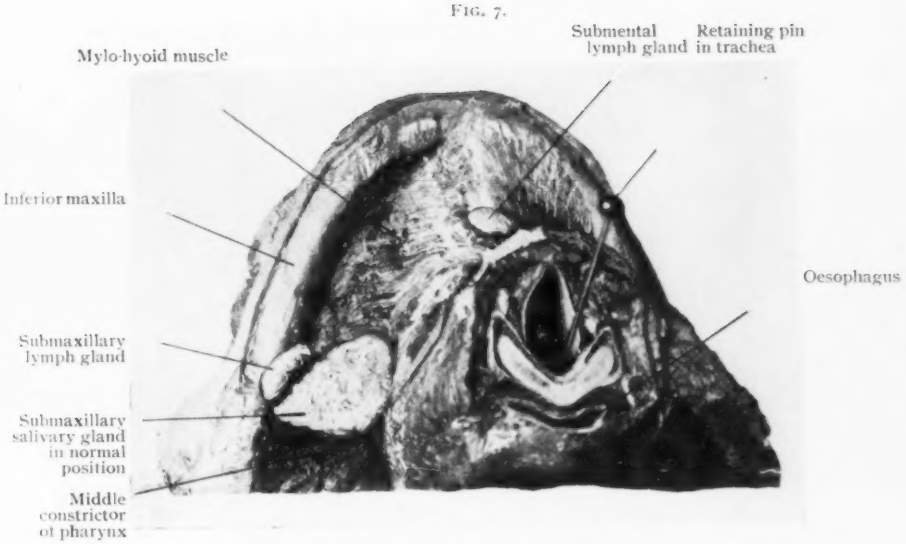
Same specimen as illustrated in Fig. 4. Tongue removed showing horse-shoe arrangement of sublingual cellular tissue and salivary glands.

FIG. 6.



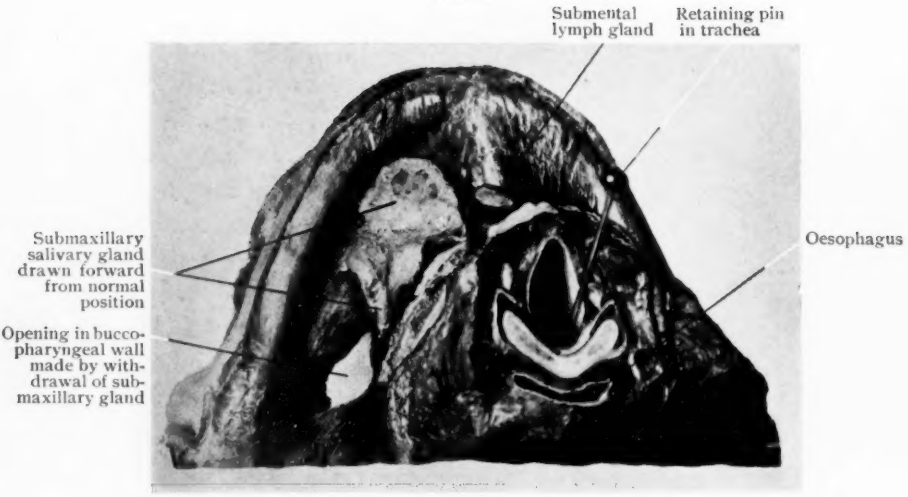

Same specimen as illustrated in Figs. 4 and 5. Horse-shoe shaped sublingual tissues turned backwards showing their continuity with similar tissue in the submaxillary region through the bucco-pharyngeal opening. The alveololingual sulci are also shown.

FIG. 7.




Same specimen as illustrated in Figs. 4, 5 and 6. External view. Submaxillary and submental regions. Bucco-pharyngeal opening plugged by submaxillary salivary gland.

FIG. 8.


Submental lymph gland
Retaining pin in trachea
Submaxillary salivary gland drawn forward from normal position
Opening in bucco-pharyngeal wall made by withdrawal of submaxillary gland
Oesophagus

Same specimen as illustrated in Figs. 4, 5, 6 and 7. Same view as in Fig. 7. The submaxillary salivary gland being drawn forward the bucco-pharyngeal opening is well shown. The fissures between the mylo-hyoid and middle constrictor muscles, however, extends from the hyoid bone to the angle of the jaw.

in it for the passage of planes of connective tissue between the mouth and neck. From the posterior border of the mylohyoid on each side, extend backward the constrictor muscles of the pharynx, separating the pharynx from the neck, the muscles of the two sides fusing together at the posterior median raphe. The three constrictors, superior, middle and inferior, overlap each other, so that here also, the submucous tissue of the pharynx is not continuous with the connective tissue of the neck through these muscles. Between the posterior edge of the mylohyoid and the anterior border of the middle constrictor, however, is a considerable deficiency in the bucco-pharyngeal muscular wall (see figure 8). This opening extends from the hyoid bone upward and backward to the inner side of the lower jaw near its angle. The hyoglossus muscle, which viewed externally forms a part of the floor of the submaxillary triangle, does not enter into the formation of the floor of the mouth or pharyngeal wall. It passes upward through this muscular opening or gap to become a part of the root of the tongue, and fills the gap considerably. Those structures which pass from the neck into the mouth or in the opposite direction, do so through this opening. These are the glossopharyngeal and hypoglossal nerves, the lingual artery and vein, and the styloglossus muscle. The greater part of the opening, however, is occupied by the deeper portion of the submaxillary salivary gland which here projects into the floor of the mouth, near the root of the tongue, where it lies just under the mucous membrane. The gland may, therefore, be said to form a small part of the floor of the mouth. The submaxillary gland within the mouth is adjacent to the posterior part of the sublingual gland and is attached to it by the surrounding loose connective tissue (see figure 2). We thus see that the connective tissue in the submaxillary fossa is directly continuous with that in the floor of the mouth, so that the extension of a submaxillary cellulitis to the sublingual region, which occurs so early and so constantly in Ludwig's Angina, is readily understood. The observations of Huguet

and DeBovis, who, while regarding Ludwig's Angina as a sublingual phlegmon, said that this "can only be the result of diffusion of an inflammation developed more posteriorly in the region of the parotid or angle of the jaw," is seen to have a sound anatomical basis. What is more important, it supports the statements of Ludwig and the great majority of writers reporting these cases, who said that it began in the region of the submaxillary gland. The difficulty in explaining why this extension occurs so rapidly in some cases is not so great as in explaining why such extension does not occur in more cases. Probably it does occur much more frequently than we have suspected and is overlooked because its nature has not been understood. It has probably been arrested many times by prompt incision before alarming symptoms have had time to develop. While walking through one of the wards of a hospital recently, the writer's attention was arrested by a case of extensive submaxillary cellulitis. The mouth could not be opened and when the patient was asked if he experienced any trouble inside the mouth he said that beginning with the day before he had considerable difficulty and pain in swallowing. An incision had been made that day. On the following day he reported that he felt much better and that the dysphagia had disappeared. The inflammation had probably begun to extend into the mouth in this case, and had been arrested by the incision. Of Poulsen's 251 submaxillary abscesses, as already stated, in 22 the swelling involved the floor of the mouth, and in 2 (not the 2 reported by Poulsen as examples of Ludwig's Angina) this swelling was so abundant that an incision in the mouth was necessary. As a rule the inflammation subsided after incision in the submaxillary region. Poulsen regarded only 3 of the 22 as examples of Ludwig's Angina, and paid little or no attention to the rest; so that we can obtain light on the progress of the other cases, only by inference from the associated facts. Of the 251, 11 or 4 per cent., died. Poulsen says that the great majority were cases of simple or localized adenitis. A death from simple or localized adenitis must

be exceedingly rare, so that almost all of the 11 deaths, in all probability, occurred among the 22 in which the floor of the mouth was invaded, since as the writer will show, this must always be a very dangerous condition. If this were true of all the 11 deaths the mortality among the 22 cases would then be 50 per cent., which is approximately that of Ludwig's Angina, as determined by other writers. In the writer's collected cases, the mortality was 40 per cent. In the anatomical specimens it was observed that the connective tissue about the gland in the opening in the muscular floor of the mouth, was small in quantity. The gland being somewhat wedge shaped, with its base external and its apex internal it is possible that a massive exudate external to the gland might force it more snugly into the opening as a plug, thus aiding in localizing the inflammatory process to the external tissues, more effectively in some cases than in others. It was generally the fulminating infections which were present in Ludwig's Angina, in all probability because of the great facility with which they extend along planes of connective tissue.

A phlegmonous cellulitis in the floor of the mouth as from an infected wound, is a menace to the life of the patient, regardless of the kind of microörganism producing it. Relief must be afforded promptly or, the process extending, the larynx will soon be invaded and the patient suffocated. To appreciate the reason for this a further study of the anatomy of the floor of the mouth is necessary.

The mouth with the jaws closed may be roughly compared to a small box of which one side has been removed. The upper side or roof is represented by the roof of the mouth, the lower side or floor by the two mylohyoid muscles, the front and lateral sides by the teeth and jaws. The posterior side is absent. With the jaws closed the mouth is practically filled by the tongue and the normal sublingual tissue. Therefore, when the cellular tissue under the tongue is invaded by inflammation, as in Ludwig's Angina, the tongue is pushed upward and the mouth must open to make room for the new inflammatory material. Speech and

deglutition are necessarily interfered with and the saliva now increased by the inflammation can not be properly swallowed and frequently escapes from the mouth. The tongue crowded for room may show between the teeth and appear to be swollen when it is not. It was actually swollen, in one of Parker's cases, from invasion by the inflammatory process (see page 343). The tip, at least, is probably rarely involved. Posteriorly the tongue becomes wider and dips downward and backward toward the larynx, where the base of the epiglottis is attached to its posterior surface. Laterally the base of the tongue reaches the side of the pharynx, where it receives the attachments of the styloglossus and palatoglossus muscles. These attachments of the sides of the tongue to the walls of the pharynx, make on each side a strong muscular ridge covered by mucous membrane and submucous tissue, the latter being scanty here. This prominent ridge separates the floor of the mouth from the pharynx, so that a submaxillary infection extending through the opening already described, and finding itself in the floor of the mouth in front of this ridge, must extend through it along the intermuscular fascia or over it along the scanty submucous tissue. This explains why the swelling in the floor of the mouth is so well developed before the oedema has produced alarming symptoms in the pharynx and larynx. The finger placed in the mouth will easily find this ridge. Since the tongue turns downward and backward, the sublingual swelling lies in front of this posterior portion, so that the tongue with the epiglottis attached to its dorsum is pushed backward toward or against the posterior wall of the pharynx, tending to obstruct the air which is passing from the nose and mouth to the lungs. By the same mechanism in anaesthesia, the dropping backward of the tongue and epiglottis may interfere with respiration.

It is probably little appreciated how limited is the space confined within the arch of the lower jaw. It will suffice here to point out that the distance in a straight line from the symphysis along the floor of the mouth to the base of the

epiglottis and, therefore, to the upper orifice of the pharynx is, approximately, only 2½ inches (see fig. 1). The submaxillary salivary gland lying in the opening in the floor of the mouth is about on a transverse plane with the base of the tongue, *i.e.,* just anterior to the larynx; so that the portion of the gland projecting into the mouth is only about 2 inches external and anterior to the larynx. The chief protection of the larynx, at first, is the muscular ridge already described.

A further brief description of the floor of the mouth will be of value in explaining some of the points which have attracted the attention of various writers. For instance, it has been frequently reported that the hard sublingual swelling was of a horse shoe shape. The floor is divided into two lateral portions (see figure 6) by the muscles which pass upward from the symphysis of the lower jaw and the hyoid bone to the tongue, the hyoglossus and geniohyoglossus. The geniohyoid aids in forming the lower portion of this median septum (see fig. 1). The two lateral alveololingual sulci thus formed are freely continuous with each other anteriorly under the fraenum of the tongue, but are terminated abruptly posteriorly by the lateral attachments of the base of the tongue. They are thus seen to have a horse shoe shape, and as they are filled by the sublingual and portions of the submaxillary glands surrounded by loose cellular tissue, the swelling due to cellulitis in them will assume a horse shoe shape also. It has been observed in a few cases that a submaxillary cellulitis of one side with extension to the floor of the mouth, has been followed in a short time by a corresponding but smaller swelling on the opposite side, the two not being continuous under the chin. Some of these cases are probably to be explained by extension of a submaxillary cellulitis of one side to the floor of the mouth, along the sublingual sulci and out through the opening in the floor of the mouth on the opposite side. More frequently bilateral swelling results from extension along the external connective tissue under the symphysis.

What has made Ludwig's Angina so important is the

frightful rapidity and certainty with which an unchecked case proceeds to a fatal termination. The submaxillary region is already intensely swollen, so that the jaw can not move downward to relieve the crowding of the mouth and pharynx. The sublingual pressure can not find relief in that direction, even if the mylohyoid muscle did not resist its downward progress. Above it meets the resistance of an overhanging probably rigid tongue, which is already pressed against the roof of the mouth. Extension anteriorly or laterally is resisted by bone and teeth. The direction of least resistance is backward, in fact it is the only direction in which the rapidly accumulating new material can force its way. When we take into consideration the fact that it enters the mouth not far from the larynx and that while the inflammation is invading the floor of the mouth it is also more slowly passing backward toward the larynx, we can better appreciate why the dyspnoea follows so soon after the swelling of the floor of the mouth.

Only prompt relief of a pus collection by incision or a spontaneous opening can be expected to give relief, and these have failed in some cases. It is true that spontaneous resolution has occurred in some cases, but this can not be depended on. Leterrier doubted if it ever occurred and believed that in those cases in which it was reported to have taken place, an unobserved spontaneous opening had developed. In the writer's 106 cases there were 17 in which a spontaneous opening was reported, and in every one there was an internal opening. In only one was an external opening associated. While he would not deny the possibility of spontaneous resolution, the writer would consider it very likely that in some cases in which it was reported to have occurred, a spontaneous opening had been overlooked. It could be so situated under the tongue that it could not be exposed on account of the difficulty in opening the mouth. Only the escape of pus would announce its presence, and this is frequently so small in quantity or so gradual that it could easily escape unrecognized in the abundant and often turbid saliva.

The spontaneous opening is usually internal, probably because pus developed about the submaxillary gland finds itself nearer the mucous surface than the skin of the neck. The inflammatory material inside the jaw and under the tongue is probably under greater pressure than that external to the gland in the neck, which is always abundant so that the inflammatory area should break down more quickly where the pressure is greatest and, therefore, the blood supply most compromised.

Of the writer's cases the following, reported by Parker, illustrates clinically better than any of the others, the mode of origin and path of progress of the cellulitis in a Ludwig's Angina.

JOHN K., aged 12½ years, was admitted to the hospital Sunday, September 8, 1878, at about 10 P.M. On the preceding Thursday (before which time he had been quite well) a "small lump" appeared below the jaw on the left side. It increased in size until Saturday, and then appeared to be an ordinary abscess of the neck. On Sunday it remained much the same until 4 P.M. Then the patient began to complain of his tongue which was swelling. By 6 P.M. his tongue had reached about quadruple its normal size and it protruded from his mouth. On admission to the hospital at about 10 P.M. there was considerable swelling below the jaw on the left side and to a less extent on the right side. No fluctuation, but great œdema. Tongue much swollen, red and tense, and protruding between the teeth, preventing closure of the mouth, which is open to its full extent. Escape of much saliva. On the following day breathing more uneasy. Incision in neck at most likely place, but no pus reached. Toward evening, on acount of great distress, the tongue was freely incised on each side of the median line with considerable relief in a short time. September 11th the condition had somewhat subsided. On raising the tip of the tongue pus can be seen issuing at a point where the mucous membrane is reflected from the tongue to the floor of the mouth, and a probe can be passed downward and backward for three or four inches. September 14th neck again incised and pus found. Convalescence soon followed.

This is probably as clear a clinical demonstration as one could find of the origin in a lymph gland, with periglandular extension to the cellular tissue, first in the submaxillary region, then to the floor of the mouth and tongue, and finally to the region of the larynx as shown by the increasing difficulty in breathing. The occurrence of the spontaneous opening under the tongue with a subsidence of symptoms, probably, had much to do with the recovery of the patient. It was the only one to be found among the writer's cases, in which the mouth was reported to be opened widely and the only one in which the tongue was markedly invaded. The opened mouth is probably to be explained by the fact that the floor of the mouth and the tongue were invaded before the submaxillary swelling had become too massive to prevent depression of the lower jaw, which in this case was demanded early for the accommodation of the early swelling in the mouth.

The writer's study of his cases does not show that the pathological changes occurring in the infected area differ materially from those which may be expected from any severe pyogenic infection occurring under similar anatomical conditions. Of the 106, spontaneous resolution was reported in 8. In 26 no pus was found. Two of these showed putrid foci. In 66 pus was found. In 12 of these the pus was described as putrid, and in 5 gas was associated. In three gas without pus was reported, and in 3 more the process was spoken of as gangrenous. While this classification is, probably, more or less inaccurate—the pus might have been putrid and the fact not have been mentioned, and gangrene might have been present and the fact have been overlooked—it will demonstrate that, in all probability, the pathological changes present were the result of ordinary severe infections, as the streptococcic or staphylococcic. The bacteriological examinations which have been made in these cases, would then be seen to have agreed with the other pathological findings. The proximity to the alimentary tract will account for the frequency of gas and

putrescence, while the intensity of the inflammatory process and the compression of the inflammatory swelling inside the jaw and under the tongue with the massive, hard, tense swelling externally, will explain the tendency to gangrene. It is probably no more frequent here than when such an infection occurs under the dense palmar fascia.

The question as to the advisability of retaining or rejecting the name, Ludwig's Angina, is one that probably will not be easily decided. While the process is pathologically identical whether it begins in the throat, in the mouth or in the neck, from the standpoint of prognosis and treatment, as already stated, a sharp distinction should be made between those beginning in the throat and those beginning in the neck. From the same standpoint those beginning with a cellulitis in the mouth by direct extension from the primary focus in the mouth (there were 8 of this type among the writer's cases) might be included with those originating in the submaxillary region. If the primary focus in these cases is exposed before the development of the submaxillary swelling prevents opening of the mouth, it can be thoroughly disinfected and the process, probably, arrested early. We might speak of these two varieties as sublingual phlegmons, one being primary the other secondary. But this would disregard the submaxillary cellulitis, which in the great majority of cases would be the primary condition and then the most important because it is the one to be attacked surgically. We might speak of this class as cases of submaxillary cellulitis with extension to the mouth and throat. Ludwig's Angina would be more convenient and would be sufficient, since this is exactly the condition which Ludwig described. Delorme, who regarded it as essentially a primary sublingual phlegmon, argued for the retention of the name, Ludwig's Angina. The writer believes that the time has not yet arrived when we can conveniently discard it.

*Clinical Course.*—While the etiology and pathology of this condition has not been established, the clinical picture as given by Ludwig has, probably, never been questioned.

He recognized the fact that various grades of severity may be met with, but presented the clinical course of the severest type, in order to emphasize the symptoms more forcibly, and to facilitate the diagnosis. From his study of the subject, the writer has been led to the conclusion that Ludwig's picture, while it may accurately describe the average case of his time, will not answer so well for that of the present. That is to say, the gangrenous or putrefactive conditions are not met with so frequently nor do they reach the advanced stage when present, which seems to have been the rule in his day. This change is due, probably to the fact that expectant treatment is now much less frequently employed. The progress of the infection is arrested earlier by more prompt incision and drainage. The irregular septic temperature, profuse sweats, delirium and progressively profound typhoid state, are by no means so common now. With few exceptions modern surgical treatment will arrest the progress of the infection or the patient will die in less than 10 to 12 days. Since his clinical picture appears to be the standard, and from time to time is given in more or less detail in journal articles, the writer wishes to present it here in order that he may apply to it briefly his own interpretation of the symptoms.

"The condition is ushered in with the usual symptoms of a rheumatic or erysipelatous angina, *i.e.*, slight fever, repeated chills, headache, coated tongue, etc., sometimes with slight difficulty in swallowing. At the same time there develops a unilateral or bilateral hard swelling usually of the cellular tissue surrounding the submaxillary gland, sometimes of that about the subligual or parotid. Extension of the process occurs in all directions along the cellular tissue, toward the chin and the opposite side, and toward the larynx, and the parotid, forming a considerable swelling. The intermuscular tissue and even the muscles become involved. The sublingual tissues form a hard, congested swelling, arranged like a cushion just inside the inferior maxillary bone; and the tongue is pushed upward and backward. The mouth

is opened with pain and difficulty. Movements of the jaw, swallowing and speaking are considerably disturbed. The skin is movable during this local stage (4 to 6 days), the general condition is little disturbed, and the fever moderate. Soon the skin becomes reddened, the sublingual swelling softens and at times shows crepitation. Occasionally fluctuation appears to be present as though pus were there. But this is not the case. Soon an opening occurs in the floor of the mouth discharging a thin grayish or reddish brown, offensive fluid, which more and more assumes in character the discharge of a putrefactive process. The constitutional symptoms now become more severe, *i.e.*, the fever is higher, sleep is disturbed, profuse sweats and delirium appear and the typhoid condition becomes more profound. Deglutition remains difficult, although the swelling becomes less tense, and suggests improvement. Dyspnoea sets in and increases, and probably indicates an affection of the nervous system rather than a mechanical obstruction of the respiratory tract. Perhaps this is due to effusion into the chest. The symptoms develop with alarming rapidity and are characteristic of a putrefactive typhoid process. Death from coma and lung paralysis occurs in 10 to 12 days from the commencement of the disease."

The following points he considers to be diagnostic:

"1. The insignificant inflammation of the throat, which often disappears entirely after the first few days, and which if it persists may be looked upon as superficial.

"2. The 'wood like' hardness of the swelling, which does not pit on pressure.

"3. The hard sublingual swelling, forming a ring just within the lower jaw, reddish or bluish in color.

"4. The sharp limitation of the indurated tissues which are surrounded by uninvolved healthy connective tissue. The slight involvement or more often lack of involvement of the glands although the inflammation attacks the connective tissue around the gland."

The writer believes that there will be nothing obscure

in this clinical picture, if we take into account the anatomical facts to which he has already called attention, and the known facts concerning the usual rapidly spreading infections of the connective tissue. It is assumed that we are dealing with a case in which the infectious germs have gained entrance through some focus in the mouth and the first signs of cellulitis have appeared in the submaxillary region, where Ludwig located them. In the ordinary case of infection arising in this way, the germs pass by the lymphatic vessels to the glands, causing no trouble in the vessels. As soon as they reach the gland they begin to produce inflammatory changes and being confined the inflammatory material produces pain. If the infection is mild or moderate, it will probably remain limited within the capsule of the gland long enough to permit a localizing barrier of lymph to be prepared. In this way is developed the ordinary localized lymphadenitis which is so common in this region. Occasionally such a localized swelling will take on rapid growth and become diffuse, *i.e.*, the infection breaks through the barrier of lymph and spreads quickly along the cellular tissue. A localized osteo-myelitis, for example in the tibia, may break through the periosteum and set up an overlying cellulitis so rapidly as to confuse the diagnosis with that of erysipelas. Much more rarely than in the localizing cases and most characteristically in streptococcic infections, the process extends from the gland to the cellular tissue so rapidly that its glandular origin is overlooked. The fever, chills, headache and early difficulty in swallowing may be accounted for by this inflammation, or it might be due to the preliminary angina present in some cases. The characteristic extensive swelling of the neck is due to extension along its cellular tissue. The superficial fascia offers no hindrance to it in any direction, while the connective tissue in the submaxillary fossa is abundant and lax and freely continuous with the same tissue in the retromaxillary and submental regions. In Ludwig's description and in almost all the reported cases the sublingual swelling and elevation of the tongue are referred to after the submaxillary

swelling has been mentioned, which is to be explained by extension through the opening in the floor of the mouth, already described. The submaxillary swelling is hard so that its extension should be hard also. The skin is at first movable and not inflamed because the process begins deeply in the lymph gland and invades the adjacent connective tissue with great thickening or swelling of the latter before it reaches the skin, which is inflamed later. The invasion of the floor of the mouth by the inflammation and its extension to the pharynx and larynx in the writer's opinion, will satisfactorily explain the troublesome dysphagia and the dyspnœa. Its early invasion of the larynx and in some cases of the lungs will explain the rapidity and certainty with which an unchecked case goes on to a fatal termination.

The following description of Ludwig's Angina, taken from Poulsen, is that given by Boehler more than twenty years ago, and was based upon a study of 35 cases. It is repeated here because of its brevity and simplicity, because it will be of value for comparison with Ludwig's more detailed account of the clinical course, and because, as the writer views it, it is nothing more than the description of a submaxillary lymphadenitis with periglandular extension along the connective tissue, due to a virulent, probably, pyogenic infection.

"Under febrile and slight disturbances in swallowing there develops in an otherwise healthy person, in the region of the submaxillary gland, of one or both sides, an indurated, in the beginning indolent, somewhat movable tumor, which appears to proceed from the connective tissue around the submaxillary salivary gland. The overlying skin is natural and movable. The swelling which is at first the size of a hen's egg, extends more and more over the side of the neck reaching as far down as the sternum. There is an infiltration of the connective tissue which surrounds the muscles of the neck, and extends to the alveololingual sulcus, the soft palate and the pharynx. The tongue from the great swelling in the floor of mouth is elevated and pushed to the

opposite side. Generally as the process extends farther, the skin of the submaxillary region becomes oedematous and dark red. Perforation occurs in the oral cavity, and in the submaxillary region with the escape of brown fetid pus. The breathing becomes laborious, and the patient dies in a state of septic intoxication."

*Autopsies.*—Of the writer's 104 collected cases, autopsies were reported in connection with 25. In only 16 of these is there a description, direct or indirect, of the condition of the larynx. Those in which such reference was found are briefly reviewed here. Thirteen showed positive laryngeal involvement, two were negative, and in one (Zillner), the writer would infer from the vague reference to the involvement of the mucous membrane, that oedema of the glottis was present. Of Cartonli's case it was said that the larynx, trachea, pharynx and oesophagus were not damaged. This patient on the day of his death had symptoms of pneumonia with orthopnoea, so that it is more than probable that death resulted from respiratory failure. The blackish condition of the subcutaneous tissue with ichorous pus oozing from its cut surfaces, was said to have extended into the tissues above the hyoid bone and under the jaw and as far as the posterior surface of the pharynx, destroying the surrounding tissues. This would have brought it so close to the larynx that the question naturally arises as to whether the condition of the pharynx and larynx was determined from their outer surfaces through an external incision, or whether the internal surface was exposed freely and the mucous membrane directly inspected. Of Macaigne and Vanvert's case it was said that the larynx was sound and that the aryo-epiglottic folds were not oedematous. Yet in this case dyspnoea developed on the second day, about 24 hours after the onset of the condition, and the patient died a few hours later, although his general condition did not seem to be very grave. In the writer's judgment, the clinical side of the case points strongly towards oedema of the glottis. Death could hardly have been due to septic intoxication. If oedema of the glottis

were present in these two cases or if these were excluded from this group, the strongest kind of a case would be made out for invasion of the respiratory tract, more especially of the larynx, as the essential cause of death in the typical Ludwig's Angina.

CASE I.—HEIN.—Man, 32 years, military officer, robust constitution. Admitted to the hospital, Aug. 15, 1823, for an indurated submaxillary swelling of the left side, which had begun some days before in the region of the submaxillary gland. Movements of tongue limited and painful. Deglutition disturbed from beginning. Could swallow only liquids. In the bucco-pharyngeal cavity, no redness nor inflammation. Respiration normal. Later swelling reached clavicle. Increased difficulty in respiration. At end of some days, softening in lowest part. Incisions here give fetid purulent liquid. No relief to patient. Death from asphyxia, Aug. 28th, the 13th day of the stay in the hospital.

*Autopsy.*—Some fibres of gangrenous cellular tissue in abscess. Surrounding tissues form a putrid mass which communicates at the level of the angle of the jaw, with pharynx. Complete mortification of muscles above and below hyoid bone, and muscles of larynx nearly completely destroyed. Mucous membrane of larynx and trachea dark colored, like gangrene. Ventricles of Morgagni contained thickened, grayish black mucosites. Other organs normal.

CASE II.—HEYFELDER.—Female, 37 years, pale, cachectic and gouty for 7 years. Towards end of August, 1837, exposed to repeated chills, which were followed on Aug. 30 by moderate fever, heat, lumbago and acute pain in right side of neck. Aug. 31, swelling in region of right submaxillary gland, was the size of a goose's egg. Movements of head disturbed. Deglutition painful. Tonsils swollen, but not inflamed. Isthmus of fauces red. Sept. 1, swelling much greater, and of "woody" hardness. Mouth opens with acute suffering. Tongue projects posteriorly. Speech and deglutition difficult but not painful. Examination of posterior part of mouth impossible. Tumor under tongue. Very considerable prostration. Sept. 3, everything much worse, and patient very weak. Cannot expectorate abundant mucus which collects in mouth. Jaws separate only a few lines. Deglutition nearly impossible. Delirium. Sept. 5, suppuration and crepitation on palpation. Deglutition and opening of mouth better, but general condition worse. Puncture at a soft spot, with escape of abundant fetid pus. Sept. 6, median incision from chin to hyoid, with escape of fetid pus, gas, and gangrenous debris. Sept. 8, coma. Sept. 9, death.

*Autopsy.*—Affected region a dark foul mass. Salivary glands pale bluish at periphery, normal in their depth. Cervical portions of vagus and recurrent nerves were a dirty red. Muscles had lost their relations in consequence of the gangrene of the cellular tissue which surrounded them.

Mucous membrane of tongue, pharynx and nose, slightly inflamed and covered with grayish mucus. Tonsils healthy. Mucosa of larynx and trachea presented a livid appearance and was covered with foul adherent mucus. Small abscesses were disseminated in the inferior lobes of both lungs. Heart soft and flabby. Turbid fluid in pericardium. Liver, spleen and right kidney softened.

CASE III.—BERMAN.—Female, 18 years, habitual good health. Complained of bad second left molar on Aug. 26, 1838. Aug. 27, on same side, appeared a hard, parotid swelling Alveolo-dental periostitis, opposite the carious tooth. Aug. 28, abscess opened itself on external side of diseased tooth and discharged a mass of fetid pus. External swelling does not diminish, and it is extremely hard. Sublingual swelling forms a hard ring around the tongue, which is pushed up against the roof of the mouth. Voice harsh and muffled. Considerable dyspnœa. Aug. 29, spontaneous opening under the tongue with escape of fetid pus mixed with blood. External inflammation progresses to opposite angle of jaw and to sternum. Deglutition and respiration very troublesome. Aug. 30, bad night. Delirium. Considerable dyspnœa. Swelling invades greater part of thorax. Aug. 31, prostration increases. Extreme dyspnœa. Deglutition impossible. Sept. 14, stupor develops, finally coma and death.

*Autopsy.*—36 hours after death. Complete mortification of muscles from chin to sternum. Impossible to recognize their structure. Voluminous cellular debris and a considerable mass of fetid pus.

Epiglottis destroyed. Mucous membrane of larynx and trachea swollen and covered by viscid mucus. Mucous membrane of pharynx and œsophagus is blackish in color. On internal surface of inferior maxilla is a fistula, communicating with the gangrenous focus.

CASE IV.—ZILLNER.—M. B., 30 years, insane for 3 years. As the result of a cold there developed a hard non-painful swelling of the left cheek. About seventh day, chills, agitation and delirium. Ninth day, spontaneous opening in the mouth near angle of jaw, discharging abundant sanious pus. Swelling continued to spread anteriorly and toward the clavicle. Thirteenth day, second spontaneous opening externally below angle of jaw. Fourteenth day, death.

*Autopsy.*—Crepitation on pressure over the whole swollen region. Overlying skin bluish red. Subcutaneous tissue granular, while hard and resistant. In the suprahyoid region, below the floor of the mouth, all the organs, mucous membrane, cellular tissue and muscles are transformed into an extremely putrid mass. Periosteum destroyed and inferior maxilla denuded, in the greater part of its extent. In the place of the submaxillary and sublingual glands there is a large cavity filled with pus, its walls being made up of connective tissue. The sheath of the sternomastoid is filled with pus.

CASE V.—FINGER.—Woman, 29 years, presented a Ludwig's Angina, on the twelfth day of a typhus fever. In the morning the sublingual gland and the surrounding cellular tissue were much swollen. Tongue considerably infiltrated and pushed against the roof of the mouth by the prominent swelling in the floor. Respiration much disturbed, causing

fear of an œdema of the glottis. Patient died in the evening, presenting all the symptoms of suffocation.

*Autopsy.*—Cellular tissue around the submaxillary and sublingual glands on both sides of the neck, infiltrated with a yellowish purulent serum, and much swollen. Muscles of the velum palati, mucous membrane of the pharynx and larynx and all the corresponding half of the tongue are much swollen and infiltrated with a pale purulent serous fluid. The infiltration descends as low as the sternum.

CASE VI.—DOIG.—R., 22 years, soldier. Has had swelling of the neck for some days. When admitted, Feb. 4, 1876, he had a painful swelling extending over the whole of the left side of the neck. Parotid, submaxillary and sublingual glands of the same side, much swollen and very painful. On the right side the submaxillary gland is equally indurated, but is not of the same size as on the left side. Floor of mouth elevated and tongue pushed upward. Hypersalivary secretion. Considerable disturbance of deglutition. Intense dyspnœa. Insomnia. Paroxysmal anxiety. Skin over swelling normal, except that it is a little œdematous near angle of jaw. Puncture here, no pus. Death by asphyxia, Feb. 8th.

*Autopsy.*—43 hours after death. All the left side of the neck, from inferior maxilla to clavicle, is a semiliquid, extremely fetid mass. All the tissues of this region, glands, muscles and cellular tissue, are nearly completely destroyed. The portion of the jaw, adjacent to the destroyed submaxillary gland, is denuded of its periosteum. In the buccal cavity, one finds the mucosa, epiglottis and vocal cords, swollen, red and covered with mucus. There are ulcers of the tonsils.

CASE VII.—CARTONLI.—Man, 50 years. Admitted to hospital on evening of October 4th, 1879. Hard right submaxillary swelling. Speaks and opens his mouth with difficulty. It was learned from his companions, that on the evening before, he was feeling well and that the swelling had not been there for more than two days. Oct. 5th, temperature in morning and evening was 39.5. Trismus present. Deglutition impossible. Esophageal sound introduced into stomach to relieve dysphagia but did not meet with any obstacle. Abundant salivation. Lungs congested. Oct. 6th, temperature 39.5. Delirious during night. During day appeared symptoms of pneumonia with orthopnœa. Tongue protrudes between teeth. Death during night.

*Autopsy.*—Left lung hepatized. Right submaxillary region hard and œdematous. Skin cyanosed. Subcutaneous tissue blackish. Small quantity of ichorous pus oozed from cut surfaces. This condition of the tissues extended more or less into the tissues above the hyoid bone and under the lower jaw. The submaxillary gland is hypertrophied, sclerosed, grayish, and on section gives issue to an ichorous material. The ichorous infiltration extended deeply internally and below to the posterior surface of the pharynx, destroying the surrounding tissues. Larynx, trachea, pharynx and esophagus not damaged.

CASE VIII.—BAKER.—J. A., 25 years. Admitted to hospital, Feb. 6, 1862. When first seen, he was suffering from "swelled neck and great

difficulty in breathing." Great swelling on left side of neck and smaller swelling on right side, extending toward median line. Skin dark purple, very brawny and here and there is boggy. Higher up under the chin is an indistinct sense of fluctuation. Mouth open. Tongue against the roof of the mouth, and of normal size, and consistency. Mucous membrane of floor of mouth elevated to level of free edges of lower teeth. Fauces cannot be seen. Dyspnœa began night before admission, when he could not breathe without being propped up in bed. Soon after admission, he was found not to be breathing. Immediate tracheotomy. Pulse stopped.

*Autopsy.*—Seropurulent, necrotic infiltration of cellular tissue and muscles. On opening trachea, the rima glottidis is found nearly closed, with effusion of semipurulent matter into submucous tissue. This extended to the epiglottis. Glandulæ concatenatæ, submaxillary and parotid glands, much enlarged.

CASE IX.—BICKERSTETH.—Man, 40 years. On admission, speech very difficult and indistinct. Breathing embarrassed. Great swelling beneath jaw. Floor of mouth raised and tongue pushed upward and backward against roof of mouth. Examination of fauces impossible. Surgeon notified and came immediately, but patient died a few minutes before he arrived at the hospital. Patient had been seized with rigors and severe pain in submaxillary region three days before admission. Shortly afterwards, there was swelling from the lower jaw to the sternum. Skin was normal in consistency, color, and mobility, but was tense.

*Autopsy.*—Shortly after death, a puncture with a tenotomy knife was made in the floor of the mouth, when a small quantity of air and some sero-sanious fluid escaped. All the connective tissue around the trachea and between the muscles is infiltrated with a seropurulent fluid, extending upward to the root of the tongue and downward into the anterior mediastinum. The submucous cellular tissue is similarly affected, producing anteriorly, sublingual tension, and posteriorly, œdema glottidis and general œdematous laryngitis.

CASE X.—MICHEL.—Man, 38 years. Admitted to hospital, Dec. 2d, and died same day. Vigorous health. Duration of disease, four days. Suprahyoid, median and lateral swelling as high as ear, more marked on right side. No fluctuation. Constriction of jaws. Swelling of buccal floor. Marked dysphagia. Dyspnœa marked also, but no threatening of suffocation. Abundant foul saliva. Speech embarrassed. Temperature at 4 P.M. 39. Origin in carious tooth, causing a submaxillary swelling, which rapidly increased. At 6 P.M. median suprahyoid incision, only blood escaping. Patient seemed slightly relieved, but at 11 P.M. he died suddenly of suffocation.

*Autopsy.*—24 hours after death. Only the larynx and adjacent organs removed. Cellular tissue gangrenous only on right side. Coffee-cup-full of phlegmonous pus in right retromaxillary region, where the lymph glands are very large. Submaxillary and sublingual glands congested and slightly indurated. Pharyngeal mucosa red and slightly thickened in its retrolaryngeal portion. Tonsils slightly enlarged with

some points of intraglandular suppuration. In cutting through the anterior wall of the pharynx there is seen a whitish, soft tremulous œdema of the supraglottic portion of the larynx. The aryteno-epiglottic folds, the superior vocal cords and the epiglottis are double their normal size. The uvula is hypertrophied and œdematous.

CASE XI.—GIBSON.—Man, 49 years. Came to out-patient department with swelling of neck below lower jaw, which began at noon of the previous day, when there was observed a scab on the right side of the neck below the jaw. At that time the swelling was enormous, extending to the chest and as high as the zygoma. Is a heavy drinker and had been drunk the evening before the trouble began. Perceptible enlargement of the salivary glands. No lymphatic glands could be felt. Skin normal in color. No pain on firm palpation at any part of the swelling. Floor of mouth considerably thickened, but tongue was not swollen or raised to any perceptible extent. Slight dyspnœa. Just beneath the jaw on the right side is a scab, ¾ in. in breadth with a pustular margin, very like a variola but having no areola. Did not feel ill enough to wish to stay in hospital, but on being warned, he consented to remain. Admitted about 1 P.M. At about 3 P.M. of the same day, he suddenly became unconscious and intensely dyspnœic. Tracheotomy done immediately, and artificial respiration carried out. Recovered and respiration became regular and rhythmical. Large tracheotomy tube introduced. A little later a median incision was made from the chin to the hyoid bone, dividing the structures almost to the floor of the mouth. Thin serous discharge. No pus. Crepitation under the skin of the chest. At 10 P.M. dysphagia, but no difficulty of respiration. Next day, 9. A.M., good night, increased swelling toward the chest. No fluctuation. No pain. 11 A.M., very feeble. Dyspnœa and considerable cyanosis of lips and face. 2.40 P.M., rapidly becoming livid and respiration more rapid. Gradually became comatose and died at 3.15 P.M.

*Autopsy.*—Emphysema detected from eyelids to nipple. Well marked œdema glottidis, the œdematous tissue partly resembling that found elsewhere, though perhaps not quite so firm. Infarctions found in lungs. Bacteriological examination showed no specific pathogenic organism. (It was of this case that Lockwood said that by different methods he later found the streptococcus in the tissues.)

CASE XII.—POULSEN.—At midday, day before yesterday, patient observed a swelling of right side of his face and difficulty in swallowing. The swelling extended farther and farther toward the submental and parotid regions. To-day (3rd day), mouth can be opened only slightly, just enough to permit the introduction of a finger, with which the isthmus of the fauces can be felt to be free. Floor of mouth considerably swollen on both sides. Swelling œdematous but non-fluctuating. No carious teeth. When the beard was being shaved, suddenly he became dyspnœic. Sat upright in bed and died in a few minutes. This was 3 hours after admission, *i.e.*, 2 days after the beginning of the attack.

*Autopsy.*—Both parotid regions and upper part of neck considerably swollen. Some œdema of subcutaneous tissue. Swelling most marked

in submental and submaxillary regions. Foul, grayish, rather thick fluid between the muscles passing from lower jaw to hyoid bone. Salivary gland somewhat thickened and its tissue to a slight extent infiltrated with this fluid. The glandular tissue seems unchanged. Same infiltration but with a clearer fluid invades the connective tissue of the neck. In the submaxillary salivary gland the infiltration of the connective tissue is somewhat more marked, and has the appearance of connective tissue pus and an inclination to abscess formation. On the right side the gangrenous pus infiltration extends between the sternomastoid and sternohyoid and sternothyroid muscles to just above the thyroid gland. It also extends along the blood vessels to the lower part of the thyroid gland. On the left side the pus infiltration extended only a little below the submaxillary gland. The lymph glands on both sides were somewhat swollen, but without pus. The pus infiltration did not extend to the tongue nor to the sublingual gland. Tonsils not swollen.

Enormous œdema of the uvula, and of the mucous membrane of the pharynx, particularly in the laryngo-pharyngeal sinus and especially in the aryteno-epiglottic folds. There was œdema also on the anterior surface of the epiglottis, a little on the posterior surface. Very marked œdema on the sides of the larynx, even as far as the vocal cords, especially on the left side, where the upper surface of the left cord was very prominent. In the left parotid gland there was œdema, and foci of pus infiltration in the connective tissue.

Case XIII.—Poulsen.—Man, 54 years, presents himself with a virulent phlegmonous swelling involving the left cheek, left retromaxillary region, and the lateral region of the neck. Some swelling of the eye-lids. Can scarcely swallow, and is hoarse, which symptoms are of a few days duration. No real difficulty in respiration. Mouth can be opened only slightly. Numerous stumps of teeth present. Fauces cannot be inspected. As far as one can palpate there is found considerable swelling of the left side. Epiglottis cannot be reached. Patient says that condition has developed in last three days. Before that he had suffered for a half day from difficulty in swallowing. Temperature 40.5°. Under chloroform, incision made in submaxillary region parallel to jaw. Finger worked into a soft stinking pus infiltration of the connective tissues, as high as the mylohyoid muscles and posteriorly opposite the parotid as deep as the pharyngeal wall. At no time did pus flow out, but there escaped from the cavity a putrid offensive odor. Irrigation, iodoform packing. Following day, temperature 41°/39.2°. Respiration freer, and swelling subsided. Still a firm infiltration in submaxillary region. Gauze removed and found to be putrid and stinking. Another incision made downward. No denudation of maxilla. Patient collapsed. Toward evening, temperature went up to 41.1°. No dyspnœa.

*Autopsy.*—Diagnosis: Gangrenous phlegmon of submaxillary region. Periœsophageal and laryngeal phlegmon. Hyperplasia lienis. In the larynx: considerable swelling and infiltration, especially on the left side. The swelling has a dusky, gangrenous appearance, as the infiltration itself, through an incision shows a dusky, gangrenous tissue. Above the left

vocal cord is an abscess the size of a pea, with thick yellowish pus, in which were found numerous micrococci of various kinds, especially long chains. The greatest infiltration is found in the intermuscular connective tissue on the left side of the trachea and larynx, close to the internal jugular vein. The infection, here, extends to the left tonsil and the upper surface is the seat of gangrenous ulceration. The process extended downward around the œsophagus, where almost to the heart, was found a thick rather firm, dusky infiltration of the connective tissue, between the mucosa and the muscularis upon the posterior and left side. In the left submaxillary region, the edges of the incision were almost black and gave a very offensive odor. (It is interesting in this case to observe the difference between the clinical and post-mortem evidence of involvement of the larynx.)

CASE XIV.—OMBREDANNE AND KEIM.—Man, 26 years. Dec. 29th, at 9 P.M., patient arrived at hospital, nearly asphyxiated. It was necessary to carry him. The swelling began on the 26th, at the same time as an inflammation about a carious tooth. Dec. 28th, dysphagia developed and already dyspnœa was present. Patient continued, nevertheless, to work. Respiration became more and more difficult. On admission, 29th, there was considerable suprahyoid, hard swelling, predominating on the left side. No fluctuation. Floor of the mouth slightly elevated and tongue swollen. Mouth full of mucus. Pulse 152. Submaxillary incision made 6 cm. long; 3 to 4 grammes of fetid pus escaped with the blood. While on operating table, respiration became more difficult and stopped. Tracheotomy and artificial respiration revived him. Dec. 30th, right side of neck more swollen and is enormous. Temperature 39.2°, pulse 140. Patient calm. Swallows liquids. Dec. 31, incision posterior to angle of jaw on left side. No pus, only blood. Temperature 39°, pulse 161. General condition worse. From first incision bloody serum and bubbles of gas can be expressed. Jan. 1, swelling invades base of neck and thorax, where crepitation can be felt. Jan. 3, swelling occupies whole thorax. Jan. 4, incision in right side of neck, evacuates some drops of pus with blood and gas. Death at 7 P.M., with an intense dyspnœa. Face cyanosed. Tracheotomy tube is always in place and working freely.

*Autopsy.*—Pleural cavities contain considerable quantity of bloody liquid, and at the fissures were fibrinous deposits. Lungs engorged with blood and serum. Nevertheless, they crepitated under the finger. A portion of the tongue, floor of the mouth and soft parts of the neck were removed. The whole of the floor of the mouth, especially at the angle of the jaw, was transformed into a gangrenous mass. The muscles of the tongue are absolutely preserved and retain their red color, but the pus has infiltrated in front of the trachea to behind the sternum, where there was an extensive discoloration. The carotid glands were in full suppuration.

The epiglottis was œdematous, turgescent and curved like a horse shoe; the two ends touching each other. The aryteno-epiglottic folds were equally infiltrated, especially the right which was nearly a centimetre

thick. The glottis and trachea were red and injected. No subcutaneous emphysema around the trachea wound. Bacteriological examination showed: streptococci, and staphylococci, the latter predominating. Injection of the pus into one of the lower animals gave rise to an ordinary phlegmon without the development of gas.

CASE XV.—MACAIGNE AND VANVERTS.—L., 62 years. Entered hospital, March 12, 1896. Previous health good. Found on waking on morning of March 11, that his neck was swollen and painful in the suprahyoid region. Yet he worked all that day. At 5 o'clock he was compelled to go to bed from fatigue, chills and high fever. At 9 P.M., March 12, swelling was considerably increased. The lesion is deeply seated because the superficial layers of tissue move easily on it. Skin normal. Swelling of "woody" hardness. Floor of mouth swollen and indurated. Mucous membrane red. Tongue pushed upward and backward. Carious teeth. Respiration difficult because of narrowing of isthmus of fauces by elevation of tongue. Dyspnœa increased on slightest effort. Speech difficult. Some constriction of jaws. Pulse rapid. Temperature 38°. General condition does not seem very grave. At 11 A.M., a few whiffs of chloroform were given and a long median incision made. This was deepened to the mucosa of the buccal floor. Neither a serous nor a purulent collection found. Abundant blood escaped. Dressing applied and patient taken back to bed. A quarter of an hour later he was dead.

*Autopsy.*—46 hours after death. Inspection showed that no pus collection had escaped the bistoury. Larynx sound. Aryo-epiglottic folds are not œdematous. Lungs are normal. All the organs are congested, but present no other lesion. (The writer questions the post-mortem report of a sound larynx in this case. Death in less than 36 hours was too rapid for septic intoxication. The patient worked nearly the whole of the first day. Temperature was only 38° (100⅘ F.), and general condition said to be not very grave, at end of the first day. Floor of mouth invaded by inflammation. Speech difficult and dyspnœa on first day, increased on slightest effort. Sudden death.)

CASE XVI.—BIEDERT AND ROBERTSON.—Male, 22 years, admitted for typhoid fever of two weeks duration. One week later, the typhoid being moderately severe, patient began to complain of some dyspnœa. A swelling developed very rapidly on the left side of the neck, just below the angle of the jaw, hard and tender. Dyspnœa increased and examination of throat showed an œdema of the whole of the pharynx and larynx and epiglottis, the larynx being almost entirely closed. Six hours after the onset the dyspnœa had become so severe that tracheotomy became imperative. This relieved him. Temperature 103°. External swelling continued to increase very rapidly and was very tender. About ten hours after the onset he died suddenly. Cause of death not clear.

*Autopsy.*—Four hours after death. Typhoid ulcers in small bowel, particularly near the termination of the ilium. Tissues of the neck very œdematous and swollen, but no evidence of breaking down. Mucous membrane of larynx, particularly about the left vocal cord and epiglottis, was œdematous, greatly swollen and almost purple in color.

*Bacteriological Examination.*—Cultures taken from spleen by Dr. Ghriskey showed the Eberth bacillus. Unfortunately no cultures were taken from the cervical region, but a microscopical examination of the swollen laryngeal tissues showed a pure streptococcus infection.

A further study of the 104 collected cases, and the writer's two, gave the following results.

*Age.*—The phlegmon was present at birth in one. In another it began on the 6th day; in a third at 3 weeks; and in a fourth at 6 months. There were 7 cases between the ages of 1 and 10 years; 6 between 10 and 20 years; 33 between 20 and 30 years; 15 between 30 and 40 years; 12 between 40 and 50 years; 10 between 50 and 60 years; and 5 between 60 and 70 years. In 9 cases the only reference to age, was that the patients were adults, and in 5 there was no reference at all to age. The greatest number, therefore, occurred between 20 and 30 years. Poulsen's 251 submaxillary abscesses, showed about the same proportion in this period. Between 16 and 30 years, he regarded as the age of carious teeth.

*Sex.*—Of the 106 cases, there were 76 males, and 20 females, while in 10 cases the sex was not mentioned. Males being more exposed to changes in the atmosphere are, probably, more frequently the subjects of angina; while among the poorer classes they, probably, give less attention to their teeth and are, therefore, more frequently sufferers from dental caries, than females.

*General Health.*—Murchison reported an epidemic of Ludwig's Angina in the Hebrides, and found that previously impaired health was associated with most of the cases. He reported none of his cases, individually, so that none is included in the writer's list. His view has received little or no support in the literature. Of the writer's 106, there were only 15 cases in which the general health, previous to the beginning of Ludwig's Angina, was considered to be in any way impaired. Two of these were gouty; one insane; 5 alcoholic; one albumenuric, alcoholic and diabetic; one worn out by privation and long walking; one was in the early stage

of secondary syphilis; one, probably, had measles just preceding the beginning of Ludwig's Angina; in one the trouble developed during typhus fever; and in 2 during typhoid fever.

There were 21 cases in which the general health was said to be good; and 10 others in which, from the vigorous occupations followed by the patients and the absence of any reference to previous health, it may be assumed that it was not essentially impaired. In 60 more there was no mention of the general health previous to the attack, or of anything which would indicate that it might have been impaired. The natural inference is that in these it was normal. In 90 of the 106, or 85 per cent. of the cases, therefore, it may be assumed that previous to the beginning of Ludwig's Angina, the general health was practically normal.

*Primary focus of infection.*—Dental caries was noted in 36 cases, in 4 the wisdom teeth being involved. So far as reference to special teeth is concerned, they were always molar or wisdom teeth, *i.e.,* those nearest to the submaxillary region. Angina was present in 11 cases, and in these there were no references to carious teeth. In one there was a wound of the mucous membrane just posterior to the incisor teeth, which had been broken by the kick of a horse. In one there was a wound of the chin. In another there had developed infection in the wound made by cutting a tongue tie. In one of the writer's cases the infection began in a similar wound resulting from a gun shot injury, producing a fracture of the lower jaw. In two cases there were ulcers on the side of the neck. In two others, otitis media seemed to be the primary focus. In one the trouble began with a peritonsillar abscess, and in one secondary syphilis was present, probably, giving lesions in the mouth and on the skin, which would account for mixed infection of the lymphatic glands. In 49 cases there was no mention of a primary focus other than the cellulitis in the neck.

*Swelling in floor of mouth.*—In 81 cases this symptom was noted. In 8 one is left in doubt as to its presence by

the description of the case, while in 17 no reference is made to it. From the associated symptoms the writer would infer that it was present in most of these 25 cases, if not in all. With the jaws so close together that one can not see the floor of the mouth, without special efforts, and the finger can be introduced only with difficulty, this symptom might easily be overlooked.

*Difficult speech.*—Disturbed speech was mentioned only in 38 cases. In 4 the patients were too young for speech. The absence of mention of this symptom in so many cases is a matter of little importance since it is not a valuable symptom. Speech must be more or less disturbed, whether the case be one of localized submaxillary cellulitis or true Ludwig's Angina, from the failure to open the mouth and the limitation of the movements of the tongue, due to the fixation of the suprahyoid muscles going to it.

*Dysphagia.*—This symptom was mentioned only in 68 cases, but was said to be absent in only one. Like disturbed speech it must have been present in many more, and for the same reasons.

*Dyspnoea.*—This symptom was present in 81 cases, was not mentioned in 20 and in three was specifically said to be absent. In two others there were syncopal attacks.

The writer has tried to show that Ludwig's Angina, probably, kills in the great majority of cases by invasion of the respiratory tract, first of the larynx and later in some cases of the lungs. The fact that dyspnoea could be overlooked in 20 cases and could have been reported absent in 3 cases, out of a total of 106, implies that in a fair percentage of cases death occurs without oedema of the larynx. The writer, however, has become convinced during his study of this subject that not all cases of oedema of the larynx give prominent and positive symptoms upon which the diagnosis can be easily made.

In the first place the two cases showing syncopal attacks, without any mention of dyspnoea were suspiciously like cases of laryngeal involvement. Death from syncope occurred in

Nelaton's case in which the submaxillary swelling was enormous and became bilateral, and the floor of the mouth was involved. In one of Huguet and DeBovis' cases, syncopal attacks occurred in a new born infant, but there was in this, as in Nelaton's, no mention of dyspnoea. There was sublingual swelling also. That dangerous involvement of the larynx may occur without the development of dyspnoea is shown by Poulsen's case (see autopsy case No. XIII). There was said to be no dyspnoea in this case, and yet the autopsy showed considerable swelling and infiltration of the larynx, especially on the left side, dusky and gangrenous in appearance. Above the left vocal cord was an abscess the size of a pea, and the process extended downward around the oesophagus in the submucous tissue almost to the heart. If dyspnoea can be absent in a case of this kind, then it is probable that oedema of the larynx existed in many of the 20 cases, in which dyspnoea was not mentioned.

Parker, writing on tracheotomy in laryngeal diphtheria, says: "Membraneous laryngitis begins in one of two ways, primarily in the larynx and by extension to the larynx. In the former the chief symptoms are those of suffocation outweighing and hiding all others. In the latter the laryngeal symptoms are preceded by those of depression and blood poisoning. As a rule this spread (to the larynx) is *very gradual* and *very insidious*. In consequence of the antecedent blood poisoning, but chiefly of the very gradual onset of the disease, the body becomes reconciled to its deprivation of oxygen; hence the suffocative symptoms, which are so prominent and so distressing in the other variety, are less marked, indeed often absent in this. Sometimes medical practitioners have themselves underestimated the gravity of the disease on account of this apparent absence of discomfort in their patients."

J. Solis Cohen, writing on the symptoms of oedema of the larynx, says: "Acute oedema of the larynx occurs so suddenly at times that the subject perishes without any premonitory symptoms whatever. Van Swieten mentions a case,

of death with sudden change in the voice, while dining. Morgagni mentions a similar case, in a physician, who suddenly became hoarse, and died at once. Porter knew of two young men found dead from oedema in the morning, without any complaint having been made by them the night previous. Ruehle mentions a young man with swollen tonsils and overheated by dancing, found dead in the morning from oedema which had suffocated him without awakening him; and likewise the case of a servant girl, slightly hoarse, who went out lightly clad in the morning, and was suffocated while going up stairs on her return. Roger, while an interne at Hôtel-Dieu, was summoned to an attendant in an adjoining ward, who died of suffocation before he could be reached; and yet there had been no complaint save of a sore throat, so slight as not to interrupt the man's work in the hospital. These instances of sudden death certainly seem to indicate a sudden occlusion of the glottis from spasm of its constrictors, rather than a mechanical death from serous effusion. It is quite probable that the oedematous condition may have existed for some hours or days undetected and unsuspected, and that some sudden inspiration of dust or of saliva, has produced an immediately fatal spasm." The writer believes that there is abundant proof in the preceding statements, to show that a patient may die from oedema of the larynx in Ludwig's Angina, without recognition by the attending physician of the laryngeal condition.

*Diagnosis.*—The first essential in making a diagnosis of any pathological condition is to have a definite conception of what that condition is. The writer's idea of it has been so fully set forth, already, that little more need be said on the subject. It may be permitted him to repeat that what Ludwig described was a virulent cellulitis beginning in the submaxillary region, rapidly spreading to the adjacent connective tissue of the neck and then into the floor of the mouth and pharynx; in consequence of which the patient's life is threatened; partly from septic intoxication, but chiefly from invasion of the respiratory tract, *i.e.*, the larynx, primarily,

and in some cases the lungs, secondarily. Those cases in which the phlegmonous process begins in the throat in the immediate vicinity of the larynx have been purposely excluded, for reasons already given. Those beginning in the floor of the mouth are not so easily disposed of; and these the writer is inclined to include with those beginning in the submaxillary region and invading the floor of the mouth, secondarily. Those beginning in the floor of the mouth practically always extend to the submaxillary region, secondarily; as may those beginning in the throat, but the latter not so constantly nor so quickly for obvious reasons. It will thus be seen that a Ludwig's Angina is not actually present until the sublingual phlegmon has developed. Its diagnosis, therefore, depends upon the recognition of the latter condition.

While in a case of submaxillary cellulitis still localized to the tissues of the neck, it would be folly to wait for the signs of Ludwig's Angina to develop, it is vital to be conpetent to recognize this condition when it is already present. With rare exceptions the teeth will be forced so close together that a finger can be introduced only with difficulty. In most cases, however, it can be introduced and by it the swollen, indurated and inflamed floor of the mouth can be felt. In some cases it can be seen without any effort to expose it, and in most cases by separating the lips and teeth as far as possible. The tongue will be elevated and may protrude between the teeth. Pain and a feeling of fulness will be experienced by the patient within the mouth. Disturbance of speech and deglutition will be more marked than in a case of simple submaxillary cellulitis. Those symptoms and more particularly dyspnoea all speak for a Ludwig's Angina.

About the only attempt at a differential diagnosis that the writer found in literature was that of Leterrier, although his ideas have been repeated by a few other writers. He said that osteoperiostitis of the inferior maxilla, adenophlegmon and hygroma of Fleischman's bursa, are the only affections with which one can confound a sublingual phlegmon. An osteoperiostitis of the lower jaw is generally a

local inflammation and is usually the result of a carious tooth. In most cases which the writer has observed it involved the external portion of the jaw. If it involved the internal surface of the jaw, it would probably still be localized; but if it gave a rapidly spreading cellulitis of the floor of the mouth which is adjacent to it, it would then be, essentially, a Ludwig's Angina, because a sublingual phlegmon, when there would be no occasion for a differential diagnosis. If distinctly localized, there would be none of the characteristic symptoms of Ludwig's Angina, and this condition would not be suggested. But such cases should receive prompt attention, *i.e.,* they should be disinfected and drained at once to prevent a possible extension to the floor of the mouth, which must always be a dangerous condition.

In an adenophlegmon, Leterrier says, one finds small rounded masses, painful and distinctly separated from each other; he further says that a sublingual phlegmon gives a single mass with special characteristics and occupying at least a part of the submaxillary region. That an adenophlegmon can give an extensive single mass in the submaxillary region, the writer believes, is a matter of common knowledge and hardly needs discussion. The cases of Ludwig's Angina, beginning as small localized swellings, to which the writer has already referred, are in all probability, instances of this kind. An hygroma of Fleischman's bursa, which is situated under the tongue, could hardly be confused with a Ludwig's Angina, since it is not inflammatory, and is distinctly localized and movable on the surrounding tissues.

The only condition, which in the writer's opinion, could be confused with a Ludwig's Angina, is a localized submaxillary cellulitis, or rather an extensive cellulitis in this region which has not invaded the mouth or pharynx. Indeed, it is only this condition which has been confused in the literature with Ludwig's Angina, and the writer has found it necessary to exclude a number of these cases which were reported as Ludwig's Anginas. Gasser, for example, reported four cases, in all of which the streptococcus was found. The

writer excluded three, because he could see nothing more than submaxillary cellulitis in them. The extension to the floor of the mouth and pharynx is what determines a Ludwig's Angina in these cases, and working upon this basis, the diagnosis should be comparatively easy. That the term, Ludwig's Angina is still useful in describing this extension, the writer believes.

*Prognosis.*—The prognosis of a sublingual phlegmon, which is the essential condition in a Ludwig's Angina, in the writer's opinion, will vary according to the virulency of the infection and, therefore according to the rapidity with which the mouth and pharynx are crowded and the larynx reached by the inflammatory process. There is also the lesser danger of septic intoxication which, of course, varies according to the virulency. Pyaemic deposits from invasion of the blood vessels, especally the veins, by the infection have resulted in a few cases, but neither this nor the septic intoxication is, probably, any more to be feared in Ludwig's Angina than in similar infections of other parts of the neck or body. Above all the prognosis will depend upon the promptness with which the condition is recognized and upon the thoroughness of treatment.

In a considerable number of cases, although free incision was made no pus was found and in these death usually resulted. Where pus was found early a cure usually followed, although in some other foci existed and a fatal termination was the result. The writer believes that some of these as well as some of the cases in which no pus was found by incision, are to be explained by the fact that one or more lymphatic glands being involved, the foci of infection were still intraglandular in some or all of them, and the incision missed them. Similar periglandular cellulitis is common in the inguinal region, where it is the rule not only to evacuate the pus, but to shell out all inflamed glands, for we have learned by experience that the inflammation in these cases will frequently continue after a considerable abscess has been thoroughly opened and properly drained. The well known

tendency of streptococcus to develop serous rather than purulent exudation in some cases, as in erysipelas, will explain the absence of pus in many. Of the writer's 106 cases, 43 died and 63 recovered. The more recent cases, however, have given much better results than the earlier, as in Ludwig's time, because of earlier recognition and more prompt and thorough treatment. There can be little doubt that a better appreciation of the pathology of this condition will lead to better results in the future.

*Treatment.*—Antitoxines are not our only hope for the future in those cases, as Semon says. Prompt surgical interference will, probably, always be of first importance. There has been considerable difference of opinion as to what this should consist of. Although spontaneous openings when they have occurred, have almost invariably been found in the mouth, incisions there have not given satisfactory results, and it is generally conceded that the external incision is best. Surgical experience has taught that incisions should first of all lay open freely the focus from which the infection is spreading. The focus in these cases is not the preliminary insignificant lesion, tonsillitis, carious tooth, etc., which, however, should receive suitable attention; but the lymphatic gland in the submaxillary region, or the infected wound, ulcer, phlegmonous inflammation about a tooth, etc., from which the infection is extending directly to the adjacent connective tissue. If this focus is on the surface within the mouth an effort should be made properly to expose and disinfect it, as with pure carbolic acid. Care must be observed, of course, to prevent the caustic from doing damage to surrounding parts. When this was done in one of the writer's cases, prompt subsidence of the inflammation and a cure followed. If such a focus is in the pharynx, it will be practically impossible to reach it and, as in Semon's cases, treatment will be of little avail. Spontaneous resolution with or without spontaneous opening, or an effective antitoxine are about all we can hope for.

When, however, the cellulitis originates in the sub-

maxillary region, the focus is, probably, in one or more of the lymphatic glands. It is in these cases that the best results have been obtained. This is, undoubtedly, due to the fact that the inflamed area, from the beginning, is better exposed for recognition and treatment. The dangerous invasion of the floor of the mouth and the pharynx is a later development, thus giving more time for arresting its progress before it reaches the larynx or lungs. Delorme reported that in one of his cases the submaxillary salivary gland was exposed without the location of pus, and that the prolongation of the incision towards the median line and through the mylohyoid muscle, located pus. There is room for question whether in such a case the salivary or a swollen lymphatic gland was exposed. The incision of necessity is a deep one in the presence of the massive, indurated exudate, which is always present. Hemorrhage is free and retraction of the edges of the wound difficult. A swollen lymphatic gland may readily be of the same size as the normal salivary gland, and under these circumstances in the absence of an opportunity to scrutinize its structure carefully the one might easily be mistaken for the other. The writer believes that in Delorme's case the pus first developed where the swelling was first observed, in the submaxillary region, and if the submaxillary salivary gland had been freely exposed by the incision it would have located it. If, however, an outlying lymphatic gland were exposed the pus collection might have been overlooked until its extension through the opening in the floor of the mouth had been reached by the extension of the incision forward and through the mylohyoid muscle.

The best incision is undoubtedly the one which Delorme selected, *i.e.,* over the submaxillary gland and parallel with the lower jaw. The frequency of the spontaneous openings in the floor of the mouth and the fact that a number of writers have reported that they did not find pus until the mylohyoid muscle had been divided, indicate that this muscle should be freely divided, at least unless frank suppuration is found before it is reached. The dangers of an external

incision increase as we approach the angle of the jaw, where the largest blood vessels of the neck and head as well as the largest branches going to the face are located. They are all, practically, posterior to this gland. The facial vein lies over it and the artery under it. The gland lies in front of the angle of the jaw, and from the anterior border of the masseter muscle where the pulsation of the facial artery can be felt as it crosses the border of the jaw, forward to the symphysis there are no blood vessels large enough to be feared. The anterior part of the submaxillary incision, therefore, should give little or no trouble, while with a little care it can be safely extended backward far enough to expose the region of the submaxillary gland freely. The mylohyoid muscle may be penetrated with the knife, finger, or a grooved director. The finger should be passed upward in the wound until only mucous membrane intervenes between it and the mouth.

Many writers have employed the median incision from the chin to the hyoid bone. It is safer than the submaxillary incision, since there are no blood vessels in the median raphe, or only small ones. If Ludwig's angina were merely a sublingual inflammation, *i.e.*, beginning in and essentially localized to the sublingual tissues, as Delorme maintained, one would expect that Delorme would select the median incision to evacuate the pus, as it is the ideal incision for an abscess located under the tongue. Yet he employed the submaxillary incision in all his cases, and this incision has been called by a few French writers following his paper, the Delorme incision. The median incision carried through the mylohyoid muscle may find pus in the floor of the mouth in the typical case of Ludwig's angina, but only after it has extended along the floor of the mouth from the submaxillary region.

The point of greatest importance, however, in connection with this whole subject, is to recognize the dangerous possibilities of every submaxillary cellulitis, and to open the infected area promptly and efficiently. If we have waited too long or our efforts have not been effectual, and asphyxia is

threatened, a tracheotomy must be done at once with the hope that the process may soon subside and recovery follow. Intubation is out of the question, at least in most cases, because the mouth can not be opened and the tongue is pushed up. Artificial respiration may be necessary to tide the patient over the crisis. The question of the anaesthetic is an important one. Local anaesthesia has been employed several times and Davis emphasizes its value. When the dyspnoea is marked the added burden of a general anaesthetic is not a trifling one. It would seem that local anaesthesia should then receive the first consideration.

*Conclusions.*—The condition known as Ludwig's Angina, is a rapidly spreading cellulitis, beginning in the region of the submaxillary salivary gland as a perilymphadenitis, and extending to the floor of the mouth and pharynx. The primary focus is some neighboring surface lesion as a carious tooth, tonsillitis or ulcer in the mouth.

The infecting organism is, usually, the streptococcus, alone or mixed with other organisms, as the staphylococcus, pneumococcus, or bacillus of malignant oedema; but it may be the staphylococcus alone or any organism capable of producing a rapidly spreading cellulitis.

Death results from invasion of the larynx in most cases. In a considerable number the lungs are also involved. The associated septic intoxication is, probably, no more severe than that which results from streptococcus infections of the same grade in other parts of the body.

The opening in the muscular buccopharyngeal wall, through which the submaxillary salivary gland projects into the floor of the mouth, is the path by which the submaxillary infection invades the mouth and pharynx.

Any rapidly spreading cellulitis in the floor of the mouth is a menace to the life of the patient, as the anatomical conditions there, favor the early involvement of the larynx.

It is this invasion of the floor of the mouth and the pharynx which determines the alarming symptoms characteristic of Ludwig's Angina. It is evident, therefore, that

a cellulitis of a given grade of severity, beginning in the floor of the mouth, is more dangerous than one beginning in the submaxillary fossa, since the larynx will be more early and surely invaded. The opportunities for recognizing and checking the danger are, therefore, correspondingly lessened. For the same reasons, the most dangerous cases are those in which the phlegmonous process begins in the pharynx or in the larynx, the danger being greatly increased in these because, even if recognized immediately, the parts can not be inspected or properly incised and disinfected.

The pathological changes occurring in the infected area do not differ, materially, from those which may be expected from any severe pyogenic infection, occurring under similar anatomical conditions. The proximity of the alimentary tract explains the frequency of gas and putrescence, in many cases in which gangrene was not reported; while the intensity of the inflammatory process and the compression of the inflammatory material, inside the jaw and under the tongue accounts for the frequency of gangrene.

The condition occurs with sufficient frequency and is sufficiently constant in its clinical course, to deserve a place as a morbid entity. No name is at the same time so brief and so comprehensive as that of Ludwig's Angina. Those cases in which the cellulitis originates in the floor of the mouth, may be included with advantage among the Ludwig's Anginas. Those in which the phlegmonous process begins in the throat, should form a separate group, from the standpoint of prognosis and treatment.

Modern surgical treatment has reduced, considerably, the number of cases in which irregular septic temperature, profuse sweats, delirium and a progressively profound typhoid state, occur.

Incisions in the floor of the mouth may be advisable in a few cases for the relief of excessive swelling, but they have rarely given satisfactory results. The median suprahyoid incision, while the safest of the external incisions, does not expose the usual primary seat of infection and should not be

selected, except to evacuate an evident purulent collection in the submental region. The submaxillary incision, *i.e.*, over the submaxillary triangle and parallel with the lower border of the jaw, will, probably, locate an existing pus collection in the greater number of cases. If frank suppuration is not found before, the mylohyoid muscles should be divided and the sublingual tissues exposed.

On account of the added irritation of a general anaesthetic to an already dangerously inflamed larynx, local anaesthesia will in all probability prove to be the more valuable means of controlling the pain during the making of the incision.

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# STUDIES IN TECHNIQUE OF CANCER OF THE BREAST OPERATION.*

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ALTHOUGH such an immense amount of superb work has been done in the extirpation of cancer, especially in recent years, it would appear that as long as our statistics continue to show so large a percentage of relapses, the operation is one in which further study on the part of all surgeons should be encouraged. It is my purpose in this paper to dwell upon certain points, some quite old, but not less valuable on that account—which, so far as I am aware, are not as generally employed as they seemingly should be; and one or two further points which are evidently of more modern origin. Of the first named group, that to which I shall first call attention, is a suggestion of the late Mr. Syme, founded on his great clinical experience. This surgeon stated with emphasis his belief that whenever an operator was not perfectly certain of the correctness of his diagnosis of mammary carcinoma because of the absence of one or more of its cardinal symptoms—such as retraction of the nipple—his first operative step should be to cut with a single stroke into the very midst of the supposed neoplasm; this for the reason that it had more than once happened to himself, and still again to some of his colleagues, that after its extirpation a supposed cancer proved to be a very thick walled abscess containing perhaps only a minute quantity of pus. By this precautionary incision the possibility of unnecessarily mutilating a woman is averted. I have personal reasons for knowing how deceptive one of these abscesses may prove to be. Thus I recall in particular the case of a patient aged 40 operated upon by me in the New York Polyclinic Amphitheatre some years ago, in which there

* Read before the New York Surgical Society, Nov. 27, 1907.

was neither history of fever, nor especial tenderness in the apparent new growth (first noticed one year before). Retraction of the nipple was absent, but this was readily accounted for by the situation of the mass which was seemingly in an outlying lobe of the breast gland on a line between the nipple and anterior axillary fold. On the other hand enlarged axillary lymph nodes could readily be palpated, high up. In a word, I am sure I should find this clinical picture as deceptive to-day as it proved then. After removal as usual of the axillary contents, and breast, the supposed neoplasm was divided and was found to contain some two drachms of pus (shown later to consist, as to microbic components, of various staphylococci in almost pure culture. The walls of the abscess were fully three-fourths of an inch in thickness and were especially dense. In this particular type of case it would seem almost certain that an approximate balance had been attained between the status of the microbic invaders and that of their cellular antagonists, neither being able to overcome and dispose of the other. We may suppose on the one hand that from exceptionally favorable local situation in the tissues attacked, phagocytic action had been unable to prevail over them—so that the pus-exciters became gradually surrounded with a wall of new connective tissues which of course grew more and more dense with the advance of time. Upon the other hand we may believe that the pus-exciters, although securing just enough nutriment to maintain their own vitality, had nevertheless been unable to multiply greatly; nor could they spread infection elsewhere. Whether this explanation be correct or incorrect the clinical fact remains. In addition to my own case just narrated, I have known personally of two others of the same type, both of which occurred in the practice of local surgeons. By an odd coincidence one of these cases was almost exactly contemporaneous with my own. A member of the class of graduates who was a witness of my own unfortunate operation, rose from his seat immediately after its completion and the division of the supposed neoplasm, and stated that he, with several others of the class, had attended, on the very

day preceding, a clinic at one of our local hospitals, at which the visiting surgeon had diagnosticated a case as one of breast cancer, but had turned the operation over to the house-surgeon. After the extirpated mass had been laid open, all present had a chance to see that it consisted of a very small abscess with surprisingly thick walls.

To substitute the diagnostic use of a coarse aspirating needle for the knife in such cases would hardly be regarded as justifiable, in my opinion, by surgeons in general; for should no abscess be present, but malignancy instead, this procedure might well open fresh channels through which the cancer could rapidly extend. Even with the patient already upon the operating table, the routine use of the aspirating needle could hardly be sanctioned. It does seem, however, that with Syme's procedure brought up to date any possible disadvantages inseparable therefrom would be greatly outweighed by the manifest advantages of such a step. In order to discount the possibility of extension of the infected area by the incision, I recommend that after a single bold stroke of the knife—which will differentiate immediately between abscess and cancer—the wound be tamponed forthwith, if pus is absent, with gauze soaked in Harrington's fluid or simply in boiling water wrung out the moment before such packing. With either liquid all lymphatic mouths will at once be sealed. If the gauze is well wrung out, enough absorptive power will remain to take up any lymph conceivably gathered in the second or two intervening between incision and packing.

When my first instance occurred I had not known of Mr. Syme's urgent counsel concerning these deceptive cases; but ever since then I have never neglected to follow his advice (having used at first tincture of iodine in place of the other styptics just enumerated).

There comes next in order for discussion the recommendation of another eminent surgeon, made at a period considerably later than the first but apparently as little heeded by the profession. I refer to the advice first advocated, as research *

* American Journal Medical Sciences, 1888, vol. 95.

shows, by Prof. A. G. Gerster,—to reverse the usual order of procedure, and, invariably to attack the armpit first, the breast last. It has seemed to me during the score or more of years since I first knew of this suggestion a matter of wonder that it should be so ignored. It is plain that when thus performed the difficulty of the operation is in no wise increased, while a great advantage accrues to the patient in the elimination of a very real source of jeopardy; to wit, the greater or less amount of squeezing, or, so to say, massaging of the breast by the retractors during its ablation; as also its handling when, separated save for its attachments to the armpit, it is used as a kind of handle to aid in dissecting out the axillary contents with which it is continuous.

It must have been the lot of every surgeon of average experience to have known of repeated instances of very rapid redevelopment of cancer after apparently radical extirpation; and next appearing as a return in loco, most commonly within the armpit or the thorax, and after such a terribly short interval as to compel the conviction that the operation had shortened rather than prolonged the span of life; that it had added to the misery of the patient, while depriving her of the reasonably long free interval in the hope of which gain, at least, she had submitted to mutilating operation.

If, as Prof. Gross, Jr., has also shown, the lymphatic connections between the tumor and the interior of the body are easily and safely divided and abolished when the axilla is attacked first in order of procedure, the breast last, then it should no longer be held justifiable for the surgeon to run any risk of squeezing "cancer juices,"—*i.e.*, lymph containing cancerous epithelial cells—into the general circulation by manipulations of the breast incidental to its removal in the order almost universally practised.[1]

A letter received this autumn from Prof. J. Chalmers

[1] Of course the wise teaching, dating from such recent years, to remove the pectorals, the breast, its tumor and all in a single mass, unquestionably lessens the peril of the reversal of the proper order of attack by the surgeon; there is less inevitable massaging of the lymphatics by retractors, etc.—still there must be some; and there never was a danger

Da Costa expresses his hearty approval of Prof. Gerster's advice in this regard. He proceeds to state that as a young graduate he was an assistant of the junior Prof. Gross, and has, as such, personal knowledge of the latter's views upon this topic. The letter goes on to say, "Gross became convinced that the proper course of procedure was to open the axilla first and remove the connections there before attacking the breast. He was originally driven to do this, however, for another reason than the entirely scientific one of Gerster's originating and of which you speak. He began with the armpit, in instances presenting large axillary lymph-nodes, because he felt that if he should then discover that the axilla could not be freed clearly, there was no use in performing the remainder of the operation."

Prof. Da Costa adds that he is perfectly convinced of the truth of the contention that the axilla should be first attacked; and "that the ordinary method of procedure *does* offer serious danger of milking lymph glands filled with cancer cells into aberrant directions and perhaps to considerable distances."

As a third reason for attacking the axilla before the breast, we have the importance of saving every possible drop of blood; for as will appear directly the axillary attack enables us to secure a notable degree of prophylactic hemostasis. After the pectoralis major has been divided near its insertion it is easy to observe those branches of the axillary artery and vein

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to the patient more unjustifiable, nor one more certainly and unobjectionably overcome, than this, by Prof. Gerster's suggestion dating from so long ago. As a further means of protection against the spread of cancer in consequence of handling and retracting, etc., while removing the breast-mass—for the danger of passage via the lymphatic vessels that enter between the ribs is not wisely negligible—the writer always seizes with a Valsellum forceps and lifts vigorously away from the chest wall during this very rapid dissection close to the ribs; and an assistant follows the advancing knife with a spread out towel, which is thus made to intervene between the cut and open-mouthed lymphatics and possible danger to them from the mass being detached.

The writer's colleague, Prof. Bodine, by choice seizes the nipple as a tractor during the breast ablation.

which supply the chest wall—notably those two quite regular ones, the superior thoracic and thoracic longa, which are found following the upper and lower edge, respectively, of the pectoralis minor. These and any additional ones seen passing chestward should as a rule be tied twice and divided between before cutting the tendon of the muscle. To reverse this procedure and begin at the breast means hemorrhage from a multitude of little twigs which requires considerable time and pains to control—all needless. Of course the main blood supply of the breast comes from the perforating arteries of the chest-wall and cannot be so reached. But since I have adopted the custom of cording the lower extremities close to the trunk, allowing thereby the accumulation of large quantities of blood in the limbs, until the pulse becomes noticeably softer than when such segregation has not been practiced, I have found the amount of blood saved by this means to be truly remarkable. (I employ this same resource before any bloody operation upon the head or trunk.)[2] Of course when the constricting bands are removed, the heart's action becomes in consequence vigorous, and the multitude of little vessel-mouths would, if neglected, bleed sharply. It is necessary therefore to seal them up by securing a firm coagulum in their mouths; and this is best done by applying to the chest wall a towel wrung out of water brought actually boiling at the table side, the hands being protected by thick rubber gloves. It is obvious that the hotter the water the better, for then the surface turns pale almost at once from coagulated albumin and fibrin. Were the water less hot it would be less safe as an application, the surgeon being compelled then to use it for a longer time than if very close upon 212° F., to accomplish the necessary vessel-sealing, and would thereby run the risk of actually cooking the flesh. In localities of high altitude in consequence of which the usual boiling point cannot be reached and where the surgeon is operating without the advantage of a steam sterilizer (by which he is able to raise the temperature to any desired point), he may nevertheless substitute for plain boiling water

[2] See March, 1907, number of ANNALS OF SURGERY.

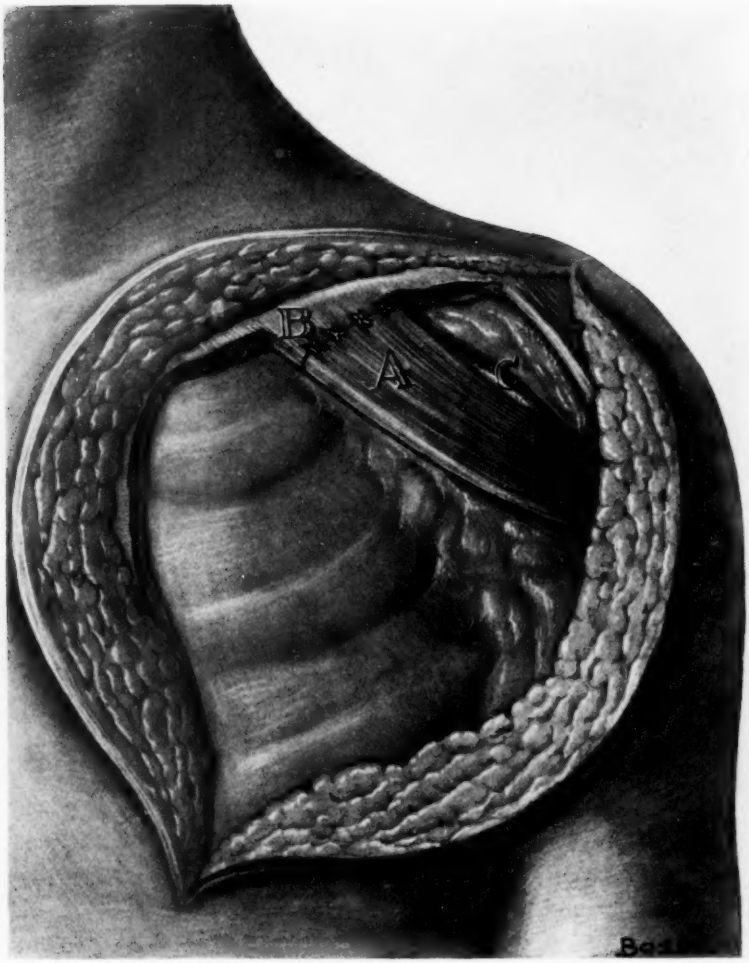
a water made more dense with salt, borax, or other rather unirritant soluble chemical, and which will thereby raise its boiling point to 212° or approximately so.

The next topic to which I would beg to refer bears upon the fact that after both pectoral muscles have been removed our patients have no other means than the action of the anterior fibres of the deltoid for the advancement of the arm nor for its adduction. When one considers the point of origin of this portion of the deltoid, it is at once obvious that if this part of the muscle sprang from the inner rather than the outer half of the clavicle its power to produce such motions would be greatly increased. Bearing this in mind, I have for several years past quite regularly adopted a plan of muscle anastomosis indicated in the illustrations, (Figures 1 and 2): the detachment from its origin of an inch (more if thought necessary) of the anterior fibres of the deltoid, the muscle being split in a direction parallel to its long axis for a distance quite short but sufficient to permit the detached portion to be sutured to a stump, of corresponding size, of the adjacent pectoralis major. This resource is of course contraindicated if the cancer extends to the vicinity of the muscles involved in such contemplated anastomosis; but this relatively seldom occurs. The stump of the great pectoral may be left an inch long (sometimes longer) in order to permit the more ready accomplishment of union of muscle to muscle. On the other hand the deltoid, as just stated, is dissected as far as it is to be so used from a level as close to the collar bone as possible. I have found three medium twenty-day tanned chromic catgut sutures to be quite sufficient; and the entire little procedure adds only some five minutes to the length of work. As a rule it is easy to avoid injury to the cephalic vein,—the preservation of which is at times so important—; the deltoid slip being fashioned so as to cross obliquely in front of the vein. So far as I have been able to determine, the portion of the deltoid entering into the anastomosis is not deprived of its innervation, nor does it undergo atrophy; though obviously, to avoid this, it should be split down for as brief a distance as good work will permit. On the other hand it does secure what is intended,

FIG. 1.

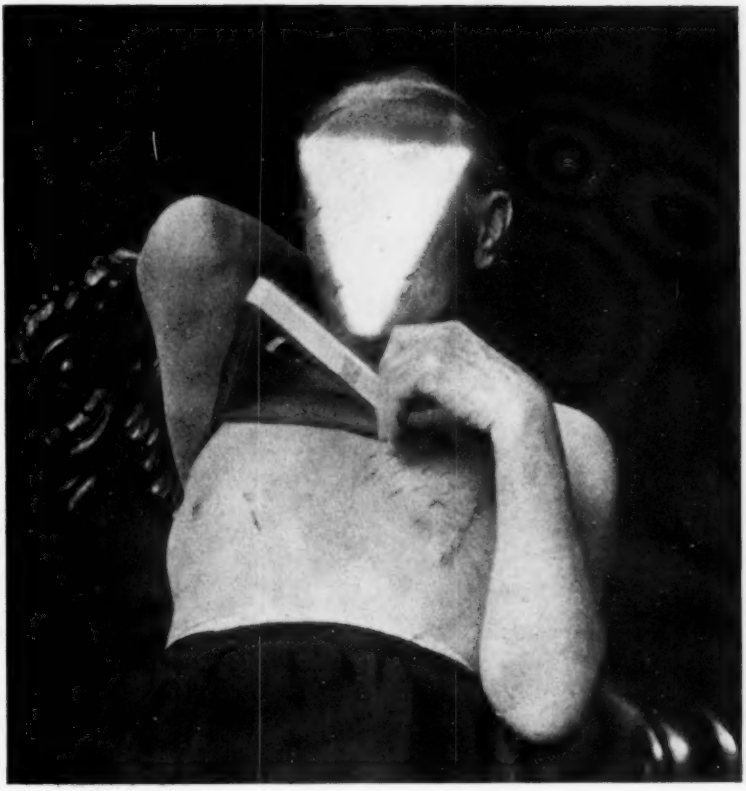
Muscle anastomosis. (A) Deltoid muscle, showing line of incision for anastomosis with stump (B) of pectoralis major. (C) Cephalic vein.

FIG. 2.



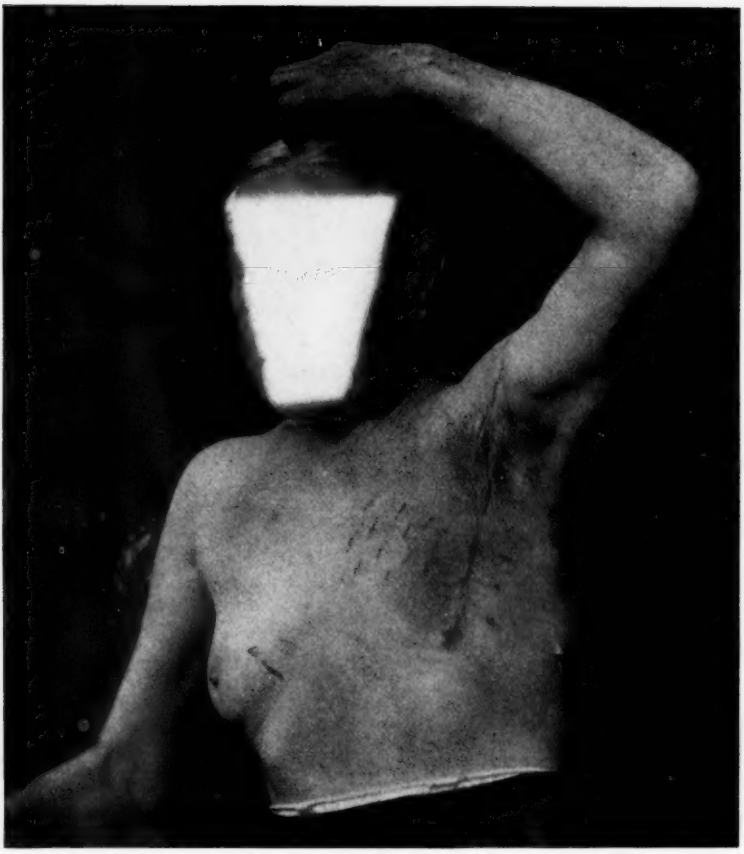

Muscle anastomosis. Deltoid muscle (A) sutured to stump of pectoralis major (B). Cephalic vein (C) behind deltoid slip.

FIG. 3.



Showing triangular splint in place although not padded.

FIG. 4.



Showing ease with which patient, 75 years old, third week after operation, places hand above her head. The short, skin-deep cuts, aiding avoidance of skin grafting are noticeable. In one instance their number was nearly 100, yet requiring but five minutes. A year later no sign of them remained.

namely facilitation of flexion and adduction of the humerus. A friend has just recently pointed out that in the book entitled "Post-Operative Treatment," by Morse of Iowa,—published last year—there is to be found, and credited to me, a description of this modification of the operation for cancer of the breast. It is evident that some medical reporter present at one of my clinics had taken notes as to this feature without calling my attention to the fact. Dr. Morse found the matter as thus reported in the Albany Medical Journal and reproduced it in his work. It is regrettable that the description is in several respects quite inaccurate; for instance the statement that my preference is for a skin-incision well towards the back of the armpit; the exact reverse of this being the truth.

As a final suggestion of those which the writer is considering in this paper, comes, in its natural order, a point in the after care. A woman who has recovered from the operation under discussion is always anxious to be able as soon as possible again to lift her hand above her head, so that she may "do her hair." When, as is commonly the case, the arm at the end of the operation is bandaged close to her side, much delay and oftentimes untold misery ensue in consequence before the axillary scar undergoes through her efforts a sufficient degree of stretching to permit of so radical a change of position.

For some years the use of a triangular splint, whereby the arm is abducted somewhat from the side (though not advanced [flexed] at all) was made use of by me as well as by various other surgeons, and found unquestionably to possess a distinct advantage. More recently, however, I have employed the triangular splint in an entirely different position, and with such satisfactory results both as to patients' toleration of the dressing in this posture and added advantage in ready elevation of the arm, after healing is accomplished, that I now feel in position to speak in positive terms of its helpfulness. The accompanying figures illustrate this gain almost without the need of words. They were taken at the end of the third week after operation. That numbered (3) shows the patient with splint in place (although not properly padded as comfort requires when in actual use). That numbered (4) shows the ease

with which the patient—an old lady—was able to lift her hand above her head after this brief period of time. This woman, nearly seventy-five years old, is a patient of Dr. Henry Moeller of this city, and was operated upon this August (1907) at the French Hospital. Her case was selected to photograph because of her age, she being the oldest patient upon whom I have made use of this position of the upper extremity *post-operationem,* and hence the most rigid test I have of its value in so speedy a return to comfort in doing the hair. When the splint is in place the patient's palm rests on the back of her neck, the front of the forearm lies in contact with her cheek, while the elbow looks directly forward and is from nine to twelve inches anterior to her chest wall, this measured distance being of course taken with thorax uncovered and not as in actual splinting, with the triangle resting upon the thick dressings bandaged in place. Any one who has slept with the hand behind the head knows that this position is not necessarily a constrained one. The "Z. O." plaster is employed for fixation, a strip of it as wide as the patient's wrist starting at the back of the opposite shoulder, thence running along the back of the hand and forearm to the elbow, where it splits into two tails and is wrapped spirally about the upper arm and that side of the triangle in contact with it. This splint—resting on top of the thick chest-dressings and not put in place until these are completed and bandaged in place—rests as shown in the photograph. It is similarly made secure with the plaster, a piece of which three or four inches wide should pass vertically from well below, up through the triangle, continuing under the forearm and ending on the skin over the shoulder blade. In the photograph marked No. 4 the scar of the drainage wound is shown, at the lowest point and close to the axillary edge of the scapula. Further, the numerous relaxing incisions into, but never through the true skin, are plainly to be seen. Without these incisions, plus subdissection to the opposite edge of the sternum, it would very likely be of uncommon occurrence to secure entire closure of the wound without resort to skin grafting, bearing in mind the extreme sacrifice of skin about cancer which wisdom demands.

# RUPTURE OF THE LUNG WITHOUT COSTAL INJURY.

WITH THE REPORT OF A CASE.*

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CASE.—James McG., aged eleven, white, was admitted to the Children's Hospital January 10, 1906, at 11.30 P.M. He had been run over by a rubber-tired brougham, the wheel apparently having passed over the the lower thorax. On admission the patient was cyanotic, with labored and rapid breathing; pulse rapid and irregular. He was unable to lie down on account of pain in the left side of the chest and difficulty in breathing. There was a slight lacerated wound over the left eye produced by the horse's hoof. The pupils were dilated and equal.

*Thorax.*—There was better expansion of the right side of the chest than of the left. Percussion note was normal throughout the right side, although the liver seemed depressed. There was dulness over the cardiac area. Over the left lung there was a tympanitic, hollow, drum-like note; fremitus was absent. Breath sounds were distant and breezy on both in- and expiration. The heart sounds were distant.

*Abdomen.*—Soft, but on percussion duller than normal; no tenderness. No movable dulness in the flanks. Urine was freely voided and contained no blood. There was a large normal movement shortly after admission.

There was no injury to the spine nor could a broken rib be demonstrated. The boy was conscious but very restless. I saw him five hours after the accident when the restlessness was perhaps not so marked owing to his having had bromides.

Examination of the chest at this time revealed the same physical signs as noted above, except that the entire cardiac area was tympanitic, apparently continuous with the stomach tympany below. The heart sounds were very distant. The pulse was still

*Read before the Philadelphia Academy of Surgery, December 2, 1907.

rapid and irregular; the abdomen was dull and the note in the flanks not clear. It was feared that abdominal hemorrhage was taking place from injury to one of the solid viscera and the tympanitic note over the cardiac area, which seemed continuous with the stomach note, suggested a rupture of the diaphragm, with hernia of the stomach into the pleural cavity. Nausea was complained of but there was no vomiting.

The boy was etherized and an incision was made to the left of the median line in the epigastrium. The abdominal contents were found entirely normal. There was no rupture of the diaphragm and no hemorrhage. A slender needle was passed into the left pleural cavity and air withdrawn with a syringe. The diagnosis was then revised to rupture of the lung alone. The ether was well taken and both pulse and respiration improved under it.

At 7 P.M. the boy was resting quietly upon his back, the breathing much easier, though shallow, the pulse had improved and he complained of no pain. The following day it was noted that the heart dulness had moved to the right of the median line and the sounds were best heard at the xyphoid cartilage. There was apparently no increase in the pneumothorax, nor was any emphysema present. The patient was much more comfortable and respiration was less difficult. From then on convalescence was uneventful and the boy was discharged February 15th with the physical signs of a slight pneumothorax still persisting.

The patient was seen again November 26, 1907, when the only evidence of previous injury to the chest was a slight impairment of resonance over the lower border of the left lung, most noticeable in the axillary line.

In rupture of the lung the physical signs will depend, to a large extent, upon the degree and the situation of the injury produced in the lung. First. The contusion may be so slight as to produce only a rupture of a few capillaries and vesicles, with extravasation of very minute quantities of blood through the lung tissue. The diagnosis of such a condition by physical signs would be impossible, and unless infection took place later, with the production of a broncho-pneumonia, it would pass unrecognized. Second. There may be rupture of the lung sub-

stance without pleural injury. Then there would be no pneumothorax, and if air entered the loose areolar tissue from a broken bronchiole it would dissect its way to the root of the lung, traverse the mediastinum and show itself at the root of the neck as a crepitant tumor. Third. In rupture of the lung with laceration of the visceral pleura, pneumothorax would probably be the immediate and prominent symptom. Fourth. When laceration is so extensive that a portion of the lung is almost severed from the rest, hemorrhage will be a prominent symptom in addition to the pneumothorax.

These various lesions of the lung may be produced in five different ways: 1. Bruising, where the force is not sufficient or not sufficiently concentrated to cause more than a slight subpleural ecchymosis.

2. Bursting, where the force is of such intensity that the lung cannot empty itself of air with sufficient rapidity. It has been likened to a paper bag inflated with air which receives a sharp blow. Whether it is necessary at the time of injury that the glottis should be closed to produce this result is a mooted point. Perhaps in some cases it is closed, for in times of sudden fear it is very common for an individual to take a short, quick inspiration and hold his breath. Yet it is easy to believe that if the force is sudden and violent the lung would not have time to empty itself of a sufficient amount of air even though the glottis were open.

3. Penetration from a green-stick fracture of a rib, where after the force has expended itself the rib returns to its normal position. Such fractures frequently cannot be diagnosed either by palpation or by the X-ray.

4. Compression of the lung against some more resistant tissue, as the pericardium, producing an injury resembling the wound of a dull, blunt instrument.

5. Tearing, where the lung has previously been glued to the chest wall by adhesions.

The condition of a lung in a cadaver and during life is so different that these injuries cannot be experimentally produced on the dead. In a dead body there is no rapidly circu-

lating blood, and the results of a traumatism in a lung full of blood and air would not be the same as in an empty one, the resistance to injury being different and perhaps lessened in the living lung.

*Symptoms.*—1. Shock. Shock is always present, and its degree seems to be proportionate to the amount of injury in the lung, and to the temporary derangement of the nerves which control the heart action.

2. Dyspnœa is always present and its degree will depend to a large extent upon the compression of the lung from the pneumothorax and to the derangement of the heart action. The more rapidly the pneumothorax forms the greater will be the dyspnœa.

3. The heart action will be interfered with owing to the traumatism of its nervous mechanism, the pneumothorax and the increasing resistance to the blood current from a collapsing lung. The pulse is therefore rapid and often irregular, and the aeration of the blood having been interfered with there will be cyanosis of the skin.

4. Cough will always be present, in part due to the compression of the lung, in part to the irritation of the injury itself. It may be short and hacking, without expectoration, or there will be hæmoptysis when the extravasated blood finds its way into an open bronchus.

5. The symptoms of pneumo- and hæmothorax will depend upon the lacerated visceral pleura communicating with an open air passage and upon the size of the vessels which are torn. With pneumothorax there may be absence of heart dulness at first, followed later by displacement of the heart. Hæmothorax will show movable dulness.

6. Emphysema. Emphysema may appear in two different localities. If it appears first in the region of the injury it would be conclusive proof that there had been a fractured rib, for it would show a laceration of the parietal pleura as well as of the visceral, with the escape of air through this avenue to the subcutaneous tissues. If it shows itself at the root of the neck as a crepitant tumor the air dissects its way in the

loose areolar tissue surrounding a bronchus into the mediastinum and from there to the neck. From either of these positions it may spread over the entire body producing an annoying complication.

*Diagnosis.*—In the majority of cases the diagnosis of a ruptured lung is not difficult; the physical signs present will clearly indicate the injury. There is one condition, however, in which an error in diagnosis may easily be made, viz., rupture of the diaphragm with displacement of the stomach or large intestine into the pleural cavity. In this condition there would be the same shock, dyspnœa and cyanosis, with rapid heart action, as would be present in rupture of the lung. The tympanitic note of the hollow bowel could hardly be differentiated from a pneumothorax, and metallic tinkling, two coin test, etc., might also be present. There would probably be a dry, hacking cough on account of compression of the lung. The tympanitic note, however, should not extend to the apex of the pleura as the lung would be crowded upward, and there should be breath sounds at the apex as well as over the root of the lung. Nausea and vomiting should be prominent symptoms in rupture of the diaphragm on account of the compression, perhaps strangulation, of the gut, and as the case progressed these symptoms would become more and more marked. In rupture of the lung nausea and vomiting, when present, appear soon after the accident and do not continue after the stomach is emptied. In both rupture of the diaphragm and of the lung there may be displacement of the heart to the right side, and in both in the beginning there may be entire absence of heart dulness.

The two main differences then would be the prominence of vomiting in rupture of the diaphragm and the fact that the tympanitic note would not be universal over the pleural cavity. However, if the lung is partially glued to the chest wall from a previous attack of pleurisy, we may have breath sounds present over certain areas, with vocal fremitus and resonance, even when the lung has ruptured and a portion of the pleural cavity is filled with air.

I have never been able to place a just estimate upon the value of auscultatory percussion. In the case just reported this method of examination gave to my ear a tympanitic note continuous with that of the stomach, and I therefore made the error of diagnosing a rupture of the diaphragm. I have seen several acute observers make a similar error in diagnosing intestinal perforation where the abdomen was distended and tympanitic, relying upon the clear transmission of sound from a distance as proof positive of the presence of air in the peritoneal cavity.

*Treatment.*—For the most part the treatment is symptomatic. Absolute rest in such position as is most comfortable to the patient, whether it be prone in bed or semi-recumbent; stimulation of the heart and sedatives for the nervous system. As a rule opium should not be given on account of its slowing effect upon the respiration. When respiration is very difficult from the pneumothorax pressure, aspiration of the pleura will usually give great relief and may be repeated from time to time. This should be done with a rather slender needle, as any amount of air may be drawn out through a small opening. If a needle of large calibre is used there will be danger of producing emphysema on its withdrawal. Strapping of the chest has been recommended for the control of the pneumothorax, but I cannot understand why it should do any good. It can only slightly decrease the capacity of the chest and it can in no way control or overcome the pressure exerted within the chest from the escaped air. The size of the pleural cavity is of no consequence; it is the pressure within which needs to be relieved. Strapping can do no good and it may impair the expansion of the uninjured lung.

If aspiration of the air from the pleural cavity is not giving the relief desired, for it will not be sufficient in cases where a fairly large bronchus has been opened, an incision between the ribs may be made or a portion of a rib excised and a drainage tube introduced. This will also permit the removal of blood from the pleural cavity and will tend to control the bleeding from the lung. Should the hemorrhage still persist

after opening the pleura, a resection of one or more ribs will be necessary, with ligation, suture, or packing of the bleeding area. When the blood which is retained in the pleural cavity becomes infected through an open bronchus, the treatment will be the same as in ordinary empyema, *viz.*, drainage.

The three principal complications or sequelæ of this injury are broncho-pneumonia, empyema and gangrene or abscess of the lung. The mortality for this injury is somewhere in the neighborhood of 75 per cent.

# ACUTE DILATATION OF THE STOMACH AND ARTERIO-MESENTERIC ILEUS.

BY WALTER B. LAFFER, M.D.

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THIS syndrome has been given a variety of names, *e.g.*, Acute Dilatation of the Stomach, Arterio-Mesenteric Ileus, Gastro-Mesenteric Ileus, Mesenteric Intestinal Incarceration, Post-Operative Ileus, Post-Operative Arterio-Mesenteric Intestinal Obstruction, Post-Operative Acute Dilatation of the Stomach, Acute Duodeno-Jejunal Intestinal Obstruction, Post-Operative Gastric Paralysis, Combined Ileus, Duodenal Ileus and Duodenal Compression.

It is but natural that a condition, or symptom complex, whose *modus operandi* and pathology are not definitely known, should have so many names.

The literature of this syndrome dates back to 1842, for at this time Rokitansky [39] described a type of acute dilatation of the stomach due to compression of the duodenum by the root of the mesentery and its vessels and nerves. In the 3d edition of his book published in 1863, in speaking of Intestinal Incarceration due to pressure of one part of the intestine or it's mesentery on another, so as to compress it against the posterior abdominal wall, he says:—

"Herewith belongs the compression of the lower transverse section of the duodenum by the mesentery of the small intestine and especially, by the superior mesenteric artery and nerves contained in the root of the mesentery."

He described a compression of the S-loop or last part of the ileum through the displacement downward of the small intestine, and he thought that this type of incarceration is favored by old age, and a long relaxed mesentery. He did not report any cases nor tell what occurred primarily to cause the mesentery to pinch the duodenum.

In 1853 Miller and Humby [157] reported their case of acute

dilatation of the stomach. Bamberger [104] as far back as 1855 called attention to the fact that serious infectious diseases are apt to produce acute gastric dilatation.

Heschl [187] in 1855 described an ileus due to compression of both the last portions of the duodenum and the ileum against the vertebrae by the mesentery of the small intestine, due to the pull exerted by the weight of the small intestine, which had been previously displaced into the true pelvis.

Brinton [127] in 1859 described acute dilatation of the stomach very precisely and endeavored to explain its pathology.

Then followed the case of Erdmann [7] reported in 1868 where trauma was the cause and this patient recovered.

Hilton Fagge [177] in 1872 gave us perhaps the first good description when he reported his cases.

Glenard [37] in 1885 independently described mesenteric ileus, and pointed out that the empty small intestine when prolapsed into the pelvis exerts a pull of 500 grammes on the root of the mesentery.

In 1891 Kundrat reported three cases of mesenteric obstruction under the title,—"Concerning a Rare Form of Intestinal Incarceration."

Then occurred the work of Schnitzler [85] which was in 1895, and which was soon followed by the very thorough résumé and critical study of Albrecht [1] of all the previous literature, and a report of two cases.

Byron Robinson,[46] of Chicago, in 1900, independently discovered and described Arterio-Mesenteric Ileus.

In France the condition was recognized by Duplay,[6] Andral,[8] Le Poil,[9] Lechaudel,[10] Thiébaut,[5] Brémont,[4] and others.

In 1902, H. Campbell Thomson [2] published his monograph containing 44 cases, all that he was able to collect in the literature.

To Neck [23, 163] Conner [188] and Braun & Seidel [141] we owe recent thorough reviews of the literature.

This subject well illustrates the truth of the saying that,

"We see only that for which we are looking," for it is surprising how rapidly the cases have increased in the literature since the publications of Albrecht [1] and Thomson.[2]

Albrecht in 1899, found only nineteen cases, including his own, and Thomson but forty-four in 1902. Neck [25] in 1905 was able to find sixty cases, while Conner [188] reported 102 at the beginning of 1907.

I have carefully gone over the American and Foreign literature of the subject and have collected 217 cases including my own.

From my own clinical records I briefly report four cases.

CASE I.—Female, aged 25. Had been well during her pregnancy. Had never had any stomach trouble. Was delivered of her first baby after labor had lasted two hours, and during which a few drops of chloroform were given. There was some hemorrhage after the birth before the placenta was delivered, but not enough to affect the pulse or color. The placenta showed a single large cotyledon connected with the placenta proper by a long, thin piece of membrane. I was unable to determine the presence of any more cotyledons that had been left behind, by inspection of the placenta.

The uterus contracted down well after the delivery of the placenta, and there was no bleeding. All went well until an hour after the birth, when I found my patient with an extremely rapid, scarcely palpable pulse, but with no blanching. She did not show any air-hunger and was conscious. There was no visible bleeding. The uterus was firmly contracted. The upper abdomen was greatly distended. I gave in succession hypodermics of ergot (for a possible concealed hemorrhage), adrenalin, ether, brandy and camphor. I sent for Dr. J. J. Thomas, an obstetrician, to aid me.

The foot of the bed was elevated, and we gave salt-solution with adrenalin as a transfusion. Dr. Thomas, on seeing the abdomen, also immediately thought of acute dilatation of the stomach, just as I had done, but in the collapsed condition of our patient we feared to pass the stomach tube. This was a mistake.

The collapsed condition persisted for about eight hours, when

the pulse became stronger and the general condition better. Patient vomited often a small amount of green, slimy fluid and belched considerable gas. For twenty-four hours she vomited all fluid that was ingested. Abdomen still very distended, but not so marked; not tender. The morning after the delivery, it was reported that she had a restless night. Temperature was 99, pulse 108. Rectal tube left in the rectum, had no effect on the distension. Lochia scant and dark in color, and she passed a large clot of blood. At first she had to be catheterized, but later voided urine normally. Later in the day she expelled gas from bowel, after a high enema. Her temperature this evening was 100.2, pulse 116. She now showed beginning necrosis of the skin and subcutaneous tissue over the right hypochondrium where we had given the salt-adrenalin transfusion. The second day following the day of delivery, nurse reported that the patient had belched gas continually all night. Distension was much less. She retained milk and broth. Temperature A.M. 98.6, pulse 100; P.M. 101.2, pulse 120. A rectal tube brought away a large amount of gas. Lochia dark in color, no odor. Uterus and abdomen not tender. Dr. Cushing saw her with me this evening and thought as Dr. Thomas and I had, that the condition was one of acute dilatation of the stomach and that the slight rise in the temperature was due to the large slough that was forming at the place of transfusion. As her bowels had not moved well, Dr. Cushing advised that effort should be made to secure free movement, which was done.

The next report showed a better night, and that considerable gas had been expelled from the bowel; A.M. temperature 101.8, pulse 120; P.M. 103.6, pulse 132. Lochia dark in color with bad odor, and a small clot was passed. No tenderness about uterus or over abdomen. Distension less. Slough over seat of transfusion loosening up and border inflamed. Bowels moved slightly twice and a great deal of flatus was passed. Distension of epigastrium nearly all gone.

The next morning a restless night was reported. Gas and stool expelled; A.M. temperature 101.4, pulse 120; P.M. 102.6, pulse 124. Later in the day bowels moved freely with a great deal of gas. Distension practically all gone. After a good night, A.M. temperature 100.4, pulse 104; P.M. 101.8, pulse 112.

The next day, A.M. temperature 100.2, pulse 112; P.M. 101.8,

pulse 116. Milk abundant in breasts. Abdomen not distended and not tender. The bowels moved well. The following day, A.M. temperature 99.4, pulse 108; P.M. temperature 101, pulse 104. Good stool and flatus passed. Slough in side tender and inflamed.

Next day, temperature A.M. 99.4, pulse 108; P.M. temperature 100.6, pulse 106. Bowels moved well. Patient ate and felt well and laughed and joked. Uterus seemed to be involuting well, but lochia was very dark and moderate in amount.

The next day, nine days after the birth, the patient suddenly had a free hemorrhage from the uterus. Both Dr. Thomas and I were called, but when we got there the bleeding had stopped. The patient's condition was good; pulse 120, little or no paleness. A digital examination of the uterus disclosed another cotyledon, which was removed. A hot sterile douche was given and the uterus contracted firmly with no more bleeding. This was at 6 A.M. All went well until 12 noon, when the patient suddenly collapsed; *the abdomen became greatly distended;* there was no bleeding and no vomiting. Pulse became more and more rapid and small, and finally, in spite of all restoratives and stimulants, the patient died at 1.30 P.M.

No autopsy was obtained, but an undertaker was immediately called to prepare her, and as the distension was so great that she could not be placed in a casket, a trocar was passed into the point of greatest distension, just below the left costal border, and a great quantity of gas and a quart of milky fluid, smelling strongly of Hoffman's anodyne that had been given her, was removed. This showed that the trocar was in the stomach. This one tapping removed all the abdominal distension.

CASE II.—Male, aged 17, schoolboy. Family history good, with no bearing on the trouble. When four years old he had scarlet fever, complicated by nasal diphtheria. At this time had a left-sided purulent otitis media with an "abscess that broke behind the ear." Otitis discharged for a year. When eight years old had otitis on the right side that discharged six weeks.

Had nasal obstruction most of the time since he had scarlet fever and diphtheria. Never had stomach trouble other than slight attacks of "biliousness" once in a long time and with which he seldom vomited. His health lately was unusually good, and appetite and digestion normal.

He was now suddenly seized with an antrum of Highmore infection on the right side, as evidenced by a swelling over same, by a temperature of from 103 to 104, pulse 80 to 90, and by a foul-smelling discharge from the alveolar process, which occurred three days later. As the general condition did not improve after the discharge began, the opening near the first upper molar was enlarged and the antrum washed out, and drained. His septic condition continued, with chills, fever of 99 to 105, and the pulse usually about 100.

Dr. Ladd obtained from his blood, and from an infusion in his left knee, a pure culture of the staphylococcus pyogenes aureus.

He developed a dry pleurisy at the base of the left lung. His bowels and stomach during all this time showed nothing abnormal. After two weeks his infection seemed to have spent itself, and his temperature came down to 100, pulse to 100, and he felt much better. He had been taking a large amount of milk and water the last few days.

I noticed one evening a slight distension of the epigastrium and the next morning it was very great, reaching to below the navel, and having a stomach-like outline. His face was anxious with sunken facies. He had a restless night and had tried to vomit, continually, but could only raise a mouthful at a time of greenish fluid. His pulse had gone up to 120. He was very thirsty. Urine scanty, but bowels had moved. Some dyspnea. Acute dilatation of the stomach was diagnosed. On passing the stomach-tube, just as the end of the tube entered the stomach, a great quantity of gas whistled out, as if under high pressure, and was immediately followed by a jet of greenish-black floculent fluid that spurted three feet from the end of tube. About two quarts of this greenish-black fluid were obtained. Lavage was practiced.

Patient felt greatly relieved and said I could pass tube any time as it gave him so much benefit. Abdomen was now flat. All feeding by mouth was stopped. Salt-solution and nutrient enemata were given, and strychnine hypodermically. Pulse came down from 120 to 100. Temperature 100. Bowels moved.

In spite of his taking no fluid by the mouth, his distension would rapidly recur and tubing morning and evening would bring away about a quart of the greenish-black fluid each time. His thirst was the most terrible and pitiful thing I have ever wit-

nessed, in spite of the salt-solution enemata and the saline transfusions that were given. He seemed to be literally dying from thirst, and would delight in dabbling his hands in the water used to keep the tube warm while giving the salt transfusion. Before each tubing his pulse would rise twenty to thirty beats and he would get restless. He became more and more collapsed, and died three days after the onset of the acute dilatation of the stomach, conscious to the last breath and begging for water to the end. No autopsy was obtained.

CASE III.—Male, aged 38, electrical engineer. Never had stomach trouble. Was operated for me by Dr. C. A. Hamann three days after onset of his first attack of appendicitis. Appendix was found ruptured and gangrenous. Free pus and cloudy fluid in abdomen. Abdomen was sponged, and a rubber tube and gauze were used as a drain. Urine not abnormal. He vomited a little after the ether.

The next day he was greatly distended, so that Traube's space was much enlarged and the area of liver dullness was almost gone. The epigastrium and the left upper abdomen were prominent. Vomited greenish fluid in small amounts, but kept trying to vomit without success. Felt very uneasy, restless, and facies were of the peritoneal type. A stomach tube was passed and a great quantity of gas and a small quantity of fluid removed. Distension disappeared and the patient felt much relieved. His pulse which was 120 dropped down after gastric lavage to 72. Flatus was passed together with a stool after a soap-suds enema. He had no more trouble on the part of the stomach and his recovery was uninterrupted.

CASE IV.—This patient was seen with Dr. Charles J. Aldrich. Male, aged 36, school teacher, an old syphilitic. He had never been rugged, but never had before any severe illness. He has not had any stomach trouble.

About the middle of December, 1906, while working as a carpenter, and while overheated, he was seized with a sudden colicky pain in his stomach, which continued for about a week, and then disappeared. Later he had some buzzing in the head and nose bleed, and still later a sensation of numbness in his right leg as if it was asleep. A day or two after this he had pain in his knees. Soon he could not feel his urine pass, and then he became ataxic. Knee jerks were exaggerated, the right more than the left, being

almost a thigh clonus. Double Babinski toe sign present. Slight loss of sensation to pain, touch, and possibly to temperature to about the level of the first lumbar vertebra. Cremasteric, gluteal and epigastric reflexes present. Complained of a drawing sensation in back when he bent over, and of a burning sensation in the thighs when the hand was rubbed over them.

During the early part of February he had a slight rise of temperature, from a cystitis and pyelitis resulting from catheterization or from a dorsal decubitus that had developed. He had become completely paraplegic with incontinence of bowel and bladder.

February 13th, his pulse suddenly rose to 140. He began to vomit greenish fluid; his abdomen was distended, especially in epigastrium. Traube's space was enlarged, and the area of liver dulness destroyed. He was in collapse. He suddenly vomited about two quarts of greenish fluid, but even afterwards showed marked distension. Vomiting was repeated a number of times during the next twenty-four hours. Stomach tube was passed, but in spite of the distension only a little fluid was obtained. Probably it was not passed deep enough to reach the fluid, as Neck [113] has pointed out.

Patient died twenty-four hours after the onset of the acute dilatation of the stomach.

*Autopsy* showed stomach had been greatly distended, but unfortunately an undertaker's assistant had run a knife into it to relieve the distension just before the autopsy. However, it was easy to be seen that it had been greatly dilated. No dilatation of the duodenum was found. No compression of the duodenum. Small intestine not in the true pelvis.

My first case was unusual in several respects. I have been able to find in the literature but one other case where acute dilatation of the stomach complicated a confinement. Thomson [49] described this case as due to a rupture of an ovarian abscess during delivery, which set up a purulent peritonitis and an acute dilatation of the stomach. Then, too, the suddenness of the onset, in my case, and the relapse a week afterwards, are not common features.

Kundrat [83] speaks of the conditions at the time of de-

livery as being favorable for the occurrence of gastro-mesenteric ileus. This seems reasonable for the sudden lowering of the intra-abdominal pressure and the possible presence of adhesions between the mesentery or intestine and the contracting uterus causing a pull on the mesentery or a kink in the intestine, would favor it. Then too, it would seem easy for the contracting uterus to push the small intestine into the true pelvis and by its weight and bulk hold the intestine down, thus causing a pull on the mesentery. It is conceivable that one might, while using Credé's method of expressing the placenta, seize a loop of the intestine or a long mesentery in his grasp and thus exert a pull on the root of the mesentery or cause a kink in the intestine sufficient to obstruct its lumen and the lack of tone of the organs at this time would not favor nature in overcoming the hindrance.

My second case was quite classical, was recognized early and treated in the most approved manner. The terrible, agonizing thirst that could neither be relieved by saline transfusions, enemata, nor by drinking, made a lasting impression on my mind.

The post-operative case was mild and belonged to the frequent type, having a general infection, a peritonitis, an anesthetic, and an operation all as possible causative factors, often associated.

The case associated with a diffuse myelitis corresponds to the case reported by Kausch [186] and others. These cases occurring with demonstrable nerve lesions ably support the views advanced by Braun & Seidel [141] and others, that the primary cause is an innervation disturbance.

Many theories and explanations have been advanced as to the cause, etiology and modus operandi of this condition or symptom complex. This is but natural, for it is probable that we are dealing with a number of different types of acute dilatation of the stomach, due to a variety of causes and having a diverse, and as yet unknown pathology.

The mooted question is whether, in the gastro-mesenteric

ileus type, the dilatation of the stomach is primary or secondary to the compression or kinking of the duodenum. The vast majority of the writers are in favor of a primary gastric dilatation and are supported in their views by the fact that at most autopsies no compression, kink nor dilatation of the duodenum has been found. This may show that in the majority of the cases the gastric dilatation is primary and that the compression of the duodenum by the root of the mesentery is likely secondary and not necessary for the occurrence of acute dilatation of the stomach.

Albrecht [1] and Glénard,[37] and others have pointed out that at the point where the duodenum is crossed by the root of the mesentery there is normally pressure enough to cause a slight hindrance to the onward flow of the contents of the duodenum, so as to hold back the bile and pancreatic juice after a meal. This slight obstruction is normally overcome two and one half or three hours after a meal, when the stomach pours out the chyme into the duodenum, which stimulates the duodenum to contract and it overcomes the obstruction. With an atonic stomach we do not have sufficient chyme thrown out into the duodenum two or three hours after the meal to enable it to overcome this hindrance.

In the gastro-mesenteric ileus type of acute dilatation of the stomach I think there can be no question but that the kinking or compression of the duodenum, due to the weight of the prolapsed small intestine pulling on the root of the mesentery and thus pinching the last part of the duodenum against the spine, is a pronounced secondary factor in keeping up the dilatation. We do not know, however, in what order of rotation these different features make their appearance, *i.e.*, whether a nervous or muscular derangement of the stomach first occurs and causes the dilatation that pushes the intestine into the pelvis, and by the weight of a full stomach on the last portion of the duodenum, aided by the compression of the mesentery, obstructs the lumen of the duodenum and thus keeps up the dilatation of the stomach; or whether the first step is the prolapse of the small intestine

into the true pelvis, due to some unknown cause, which exerts a pull on the mesentery so its root compresses the last portion of the duodenum against the spine and thus causes a dilatation of the duodenum and the stomach.

Chavannaz [64] thinks that the distention of the stomach to the symphysis would naturally prevent, by its weight and pressure, the passage of fecal matter along the bowels and thus cause more or less obstruction.

Rokitansky,[39] who was the first to describe the gastro-mesenteric ileus type of acute dilatation of the stomach, thought that the sagging or prolapse of the intestine into the true pelvis exerted by its weight a sufficient pull on the mesentery to pinch the duodenum against the spine so as to close the lumen, and cause the duodenum and stomach to dilate.

Albrecht [1] has ably championed this explanation and has reported nineteen cases which he found in the literature. He conducted some experiments on the cadaver and found that a two kilogram weight exerted enough pull on the mesentery to compress and close the duodenum and only a great intra-duodenal pressure of water was able to overcome the compression.

Glénard [37] stated that the empty small intestine when prolapsed into the true pelvis caused a pull of about 500 grams on the mesentery, pinching the duodeno-jejunal border against the spine and that it was necessary for the duodenum in order to empty itself into the jejunum, to overcome this weight.

Conner [188] experimented on ten cadavers; with the bodies in the dorsal position and the organs in place, the small intestine was removed and the mesentery gathered up into a mass and fastened to a cord which was passed into the pelvis and out through the anus and was allowed to hang free. Different weights were attached to this cord and the stomach and duodenum were then filled through the œsophagus, by a small tube of water from the tap, and the pressure necessary to overcome the duodenal obstruction estimated by connecting the tube with a mercury manometer. The results differed

greatly in different cases. In 3 instances the obstruction seemed to be due almost entirely to the weight of the distended stomach on the end of the duodenum, and with this raised, very little interference with the flow of the water into the jejunum was produced by a weight of 500 grams, or even 1 kilogram, attached to the mesentery. In each of these three cases a certain degree of gastroptosis existed. In the other cases a load of 500 grams (the approximate weight of the empty small intestine) produced an obstruction, to overcome which required a water pressure varying from 10 to 48 mm. of mercury. In some of these cases the stomach gradually distended to a point where it lay upon the duodenum, and by its weight increased somewhat the obstruction caused by the tense mesentery. In other instances the dilated stomach did not rest upon the duodenum and exerted no influence whatever upon the mesenteric obstruction. Conner concluded that in a certain proportion of normal individuals a pull upon the mesentery approximating, in direction and force, that which might be exerted by the empty small intestine hanging in the true pelvis can produce obstruction at the lower end of the duodenum which will require very considerable force to overcome.

The compression of the duodenum by the mesentery is thought to be favored by several special features, as for instance Rokitansky,[39] Müller,[33] Kundrat [83] and Schnitzler [85] think that in order for the small intestine to prolapse into the true pelvis and thus exert this pull, it is necessary for the mesentery to be unusually long, or relaxed. Schnitzler [85] and others think a partially twisted mesentery, or a mesentery of the partially-closed-fan shape, instead of the open-fan shape, favors the localization of the pressure on a small section of the duodenum and thus more easily closes its lumen. Schnitzler [85] has shown on the cadaver that when the root of the mesentery is inserted to the right of the median line it is more easy for a pull on it to compress the duodenum than when it is inserted to the left.

Müller [33] found it very difficult in fat individuals to

produce much compression on the duodenum by pulling on the mesentery, but after the fat was removed from about the root of the mesentery it was possible to compress the duodenum in these cases. Hence emaciation is considered to favor the occurrence of gastric-mesenteric ileus.

The prolapse of the small intestine into the true pelvis thus causing a pull on the mesentery Conner [188] says is the *sine qua non* to the production of such mesenteric occlusion of the duodenum. This view is supported by Rokitansky,[39] Albrecht,[1] Glénard,[37] Kundrat,[83] Schnitzler,[85] Müller,[33] Meyer,[75] Riedel,[185] Schulz,[88] Kausch,[186] Robinson [46] and others.

While most writers have failed to state why the small intestine prolapsed into the pelvis, yet some, especially Byron Robinson,[46] have thought that there was in these cases ptosis of the abdominal viscera with relaxation of the abdominal walls. Robinson [46] has studied several hundred autopsies with this point in mind and found fifteen or twenty cases which showed distinct and extensive gastro-intestinal dilatation which began in the duodenum on the right side of the superior mesenteric artery and vein. He believes that gastro-duodenal dilatation is the direct cause of many deaths of patients with visceral ptosis after they have passed forty years of age. He says further that duodenal obstruction arises in the anatomic fact that, (a) the transverse duodenal segment in the cases of visceral ptosis does not travel distalward as rapidly as does the enteron. (b) In adult man the duodenum possesses a mesenterii membrana propria only. It does not possess a peritoneal mesentery, which fact alone explains why the duodenum does not move distalward as rapidly as the enteron, as the latter possess a long mesentery.

In order to enter the true pelvis the small intestine must be empty even of gas and Müller [33] and others have spoken of the purgation and fasting previous to operations, as emptying the intestine and thus allowing it to prolapse into the true pelvis.

Lichtenstein [161] puts forth the theory that we may be

able to explain the arterio-mesenteric ileus by an abnormal congenital attachment of the mesocolon to the peritoneum of the duodenum and to the posterior parietal peritoneum. Under or behind this line of attachment of the mesocolon, the last part of the duodenum passes to merge into the jejunum. He thinks it conceivable that certain variation from the normal structure at this point would render this individual disposed to this form of ileus by any distension of his stomach.

Glénard [37] says, that while the mesentery always, normally, slightly constricts the lumen of the duodenum, yet in some cases as Rokitansky [39] and Müller [33] have pointed out the mesentery is so long that even when the small intestine prolapses into the true pelvis no pull is exerted on the mesentery.

Against the theory that the compression of the root of the mesentery on the duodenum is the primary cause of the so-called arterio-mesenteric type of acute dilatation of the stomach, we have the following evidence:—First, living bodies must act different than the toneless dead bodies without innervation, that were experimented on by Albrecht, Conner, Kelling, Gubaroff and others, so that their experimental evidence is of doubtful value.

We know too, as Hanau and others have pointed out, that the small intestine is often found in the true pelvis at autopsy, yet gastro-mesenteric ileus is rare.

Kelling [108] thinks it striking that the small intestine when found incarcerated in the pelvis in no instance showed œdema, cyanosis or any circulatory disturbance.

Seeling [140] thinks that Zade [116] is correct in believing that gastro-mesenteric ileus is never caused by the mere gravitation of the small intestine into the pelvis, if all other intra-abdominal conditions are normal.

Rieder [66] has shown by giving normal individuals bismuth and then examining them by means of the X-ray, that the jejunum and ileum occupy the middle region of the abdomen usually, but often a part of the true pelvis. The last

portion of the ileum especially is frequently found in the true pelvis normally.

Braun & Seidel [141] have called attention to how rarely acute dilatation of the stomach of a slight degree or in its early stage is seen, which is not the case in other forms of mechanical intestinal closure. They also speak of the rarity of changes being found in the intestinal wall at the point where the mesentery compresses the duodenum. Bäumler's [99] case being the only one to show any change in the the intestinal wall. They also point out the absence of ascites or peritoneal exudation as found in other forms of intestinal closure lasting a number of days.

While in the cases of Meyer,[75] Riedel,[185] Schulz,[88] Kausch [186] (2 cases), and a number of others, the small intestines were in the true pelvis, the last part of the duodenum was not found dilated; and in the cases of Hood, Kirch,[130] and Thomson [2, 49] the distension of the small intestine extended past the duodeno-jejunal boundary. In Thomson's [49] case the dilatation extended throughout eight feet of the small intestine and then passed abruptly into collapsed bowel, without any constricting force or obstruction being demonstrable.

In only 27 cases in the 120 autopsied cases in the 217 cases of acute dilatation of the stomach reported in the literature was the dilatation found to be of the gastro-mesenteric ileus type.

Therefore as there has not been a compression of the duodenum nor a dilatation of the duodenum found in the majority of cases autopsied, we cannot accept the view that the mesenteric compression is the usual cause of acute dilatation of the stomach. With the vast majority of cases being evidently due to some other cause, and with no satisfactory explanation of why the small intestine prolapses into the pelvis and when prolapse sometimes does and sometimes does not cause the mesentery to constrict the duodenum, we cannot believe that when mesenteric compression is present that it has been the first cause of the gastro-duodenal dilatation. It seems more

likely that a primary gastric dilatation of nervous origin pushes the small intestine into the pelvis and holds it there thus sometimes causing a sufficient pull on the mesentery to compress the duodenum. The weight of the full stomach resting on the duodenum, in some cases, aids in obstructing its lumen, as Conner [188] has shown.

Kelling [108] offered the following explanation, supported by clinical observations, and experiments on the cadaver and on dogs. He thinks it necessary to first assume that both openings of the stomach must be obstructed in order for acute dilatation of the stomach to occur, for if one is patulous the stomach will empty itself through that opening before marked dilatation can occur. He therefore directed his attention not only to the pylorus and duodenum but also to the cardia and œsophagus. He found that when he inflated the stomach of certain cadavers through a canula in the anterior stomach wall, that the cardia was closed by a valve-like fold of the mucosa. This valve-like action being aided in closing the œsophageal opening by the distended fundus pressing on the œsophagus from the side. The degree of resistance of this valve-like fold of mucosa to the intra-gastric pressure varied greatly according to its development. In cases where practically no fold of the mucosa was found, the stomach easily emptied itself, but when the fold was well developed it resisted a pressure sufficient to burst the stomach. Gubaroff [109] has also pointed out this valve-like fold. Kelling thinks that there are people that cannot vomit owing to the marked development of this fold.

Kelling showed on dogs that with a canula in the anterior wall of the stomach that it was impossible to produce, in the state of consciousness of normal dogs, any great dilatation, for the stomach emptied itself when the pressure reached about 25 cm. of water, through the vomiting or eruction reflex being set up. But if you narcotized the dog or cut both vagi you could distend the stomach until it burst. He thinks this is due to the fact that while normally the cardia is opened by the action of the figure of 8-like fibres of the

diaphragm muscle, which enclose the œsophagus and are inserted into it, the activity of this opening apparatus of the cardia is destroyed or inhibited by an anesthetic or by cutting both vagi.

Kelling claims that on the cadaver he was able to show that with certain individuals the simple overfilling of the stomach produces a spontaneous closure of the cardiac opening and a kink of the duodenum. The kink of the duodenum being favored by anatomical conditions or by adhesions, and it may occur at any point in the duodenum, above or below the papilla of Vater.

He thinks that the narcosis is the chief factor in producing the acute dilatation in surgical cases, but here we must have the anatomical conditions of cardia and duodenum favorable before the narcosis can produce this effect on the muscular tone of the stomach and the cardiac opening apparatus. Then too the stomach must be overfilled, preferably by food that is highly fermentable and which if retained will form quickly a great amount of gas and thus rapidly distend the stomach.

Others have repeated the experiments of Kelling with more or less different results. Von Mikulicz [174] found the resistance of the cardia to intra-gastric distension too variable to make possible any deductions from his experiments. Conner [188] inflated the stomachs of 12 cadavers and found that in 7 instances very considerable distension of the stomach occurred before there was any leakage of air through the œsophagus, but such leakage always took place when the air reached a certain height, which, measured by a water manometer, varied between 15 and 26 cm. In the other five cases air passed freely into the œsophagus and no distension of the stomach could be produced.

Conner's results in the matter of duodenal obstruction were also somewhat at variance with those of Kelling. He found with the œsophagus ligated and the stomach inflated, obstructive duodenal kinks were seen in only three cases, and in each of these air passed the obstruction when the in-

tragastric pressure measured 22 cm. or less by the water manometer. In each instance the kink formed at the junction of the superior with the descending limb. In one of these instances the air, after passing the kink at 20 cm. pressure, found further obstruction at the point of crossing of the root of the mesentery. In four other instances obstruction occurred not in the duodenum but at the pylorus, which was tightly closed and required a pressure of from 15 to 25 cm. to overcome it.

Reichel [102] believes he has shown by experiment that artificial kinking of the intestine is not enough in itself to produce a complete occlusion, but there must be in addition a peritonitis at this loop of the intestine.

Braun and Seidel [141] experimented on 19 cadavers by distending the stomach through a gastric fistula and showed that there was frequently a half-moon shaped fold of mucosa on the left side of the œsophageal insertion, but they could not show that it had a valve-like action, for in two of their cases where the greatest tension was resisted the fold was absent or just barely feelable. They found that the fundus was greatly developed in these cases and when it was distended it forced the diaphragm upward. When one pressed down on the fundus by inserting the hand between it and the diaphragm the air escaped into the œsophagus. Pressure on the stomach in imitation of the action of the abdominal walls did not cause the air to escape into the œsophagus. They agree with Kelling and Gubaroff that the kinking of the œsophagus and the way the stomach is fixed to the diaphragm favors the firm closure of the cardiac orifice.

Braun and Seidel [141] think that in addition we have a very important factor in the greatly developed high reaching fundus which favors the kinking of the œsophagus and probably also compresses the œsophagus from the side. They found it necessary, in order to get distension of the fundus, that there be a certain amount of closure of the cardia, and that the stomach walls were not supported by touching the other organs or the abdominal walls. They think the reason

that Kelling got a resistance of the cardiac orifice to pressure so often was that his experiments were conducted with the abdomen open. Braun and Seidel found that the same cases that allowed the gas to escape through the cardia with the abdomen closed did not allow it to escape when the abdomen or chest were opened. The open abdomen favors kinking of the œsophagus and removes the support of the belly walls and organs from the stomach.

Braun and Seidel[141] point out that Sauerbruch and Haecker have determined by experiment that the cardia is not closed by a sphincter. Sinnhuber has inserted his finger in the cardia of living patients and has felt an inspiratory constriction and Braun and Seidel agree with him in thinking that in the living there is a tonic contraction of the cardiac orifice and the closure is made more forcible by the diaphragm muscle fibres encircling the œsophagus, and also by the œsophagus not being inserted into the stomach at its highest point so that the distension of the fundus enables it to press on the œsophagus from the side and close the œsophagus.

Braun and Seidel[141] only once were able, during their inflation experiments, to observe a kinking or closure of the duodeno-jejunal border and then the empty small intestine lay in the true pelvis. They think this result as well as the results that Kelling obtained were due to the abdomen being open and the organs not in the same position and condition as with the closed abdomen. They think it unwise to compare these conditions, with the absence of peristalsis and the lack of gastric and duodenal muscular tone, to the conditions in the living body.

Braun and Seidel experimented on twenty dogs with the hope of throwing light on the question. They first made a Witzel gastric fistula in each dog and allowed the animal to fully recover from the operation before they did their experimental work. They found, as Kelling had, that the conscious dogs after inflation of the stomach, promptly emptied the organ by ructus and vomiting; but when the

dogs were deeply narcotized the gas did not escape even with the pressure increased to the point of rupture of the abdomen. The distension being so great as to cause the breathing to be shallow or to have stopped, and the pulse small and irregular. On awakening these dogs promptly expelled the gas by belching or vomiting.

They cut the vagi in some dogs and cocainized them in others and found that these animals were unable to empty their stomachs after tartar emetic was given, but vomited promptly after apomorphine (a centrally acting emetic) was given. They found that cutting the splanchnics had an inhibiting influence on the vomiting, even after apomorphine was given, but this inhibition passed off in a few days. Cutting the sympathetics seemed to have no effect on the vomiting reflex.

Section of the spinal cord between the last cervical and the sixth dorsal prevented vomiting even after apomorphine was injected. This showed the importance of the gastric innervation fibres passing through the cord above the sixth dorsal vertebra on the gastric motor apparatus. The absence of vomiting after section of the cord above the sixth dorsal was not due to shock for section of the cord below this point did not prevent vomiting.

They were able to show by section of the innervation paths that the abdominal walls are not necessary to the vomiting act.

They concluded that the vagi are the most important of the gastric centripetal nerve paths from the stomach to the centers in the cord and brain and that a certain motor and secretory paralysis occurs after cutting these nerves.

From a study of their clinical cases and the above described experimental work on the cadaver and on dogs Braun and Seidel conclude that acute dilatation can best be explained on the ground of a primary central or peripheral disturbance of the gastric innervation apparatus. In their cases they think that the anemia, or narcosis, or both, caused a disturbance of the vomiting reflex so that the stomach did not

fully relieve itself, but allowed over-distension to occur, and reminded them of the dogs with the vagi cut, where the vomiting centers were late (or were not stimulated) to act over other paths. With these dogs they got slight vomiting, only after a colossal distension of the stomach.

They think their cases cannot be explained by a mechanical hindrance such as a compression of the mesentery nor by a muscular insufficiency, but are to be explained rather by an innervation disturbance due to the narcosis and the operative procedure. Probably the ether or chloroform paralyzed the vomiting centers as in the case of the dogs.

While the vomiting centers are paralyzed in man during the narcosis, we have on awakening, an excitable condition of the centers, as shown by the post-anesthetic vomiting. After this hyperexcitability of the centers has continued a variable period the centers become normal in most cases, but in others it is followed by a condition of lessened excitability, or exhaustion, or even of paralysis. It is when this last condition occurs that we have acute dilatation of the stomach produced.

This explains the cases of Morris,[180] Robb,[55] and Riedel[185] where the anesthetic seemed to be the only thing that could have caused the dilatation. Where an anesthetic and an operation are associated it is difficult to tell which is to blame.

Braun[141] thinks his cases 1 and 4 were due to a reflex nerve disturbance. Von Herff[190] blames an innervation disturbance for his case which occurred after a hysterectomy. Grundzach[41] and Kampmann thought that innervation disturbance caused their cases.

The cases of Kelling,[108] Perry and Shaw[86] (Buzzard),[151] Kirch[180] and Kausch[186] where acute dilatation of the stomach followed the application of a plaster jacket (often after a hearty meal) may have been due to an interference with the stomach or intestinal motility; but even here, as the cases occurred after extension and straightening of the spine, with fixation of the vertebral column in a strained

position, we might consider with great probability, that there had occurred a slight injury to the cord or at least to the gastric spinal nerve roots.

In the cases associated with either local or general peritonitis the gastro-duodenal dilatation is probably due to an innervation disturbance either through the local effect of the inflammation on the gastro-intestinal nerves or to the general effect exerted on the centers and nerves by the toxemia of the infection, which may cause a paralysis of the entire gastro-intestinal tract.

Riedel [32] thinks there is often a serous infiltration of the walls of the stomach which lessens the peristaltic waves, especially after gall-stone operations, and this causes a primary weakness of the stomach walls which leads to a fluid accumulation in the stomach. Halsted [101] reports a case operated on for gall-stones where an ileus of the first portion of the duodenum and the pyloric end of the stomach was found and accurately corresponding to this distended portion of the bowel was a slight peritonitis, scarcely more than an injection of the serosa with only enough exudate to cause very slight adhesions between the duodenum and gall-bladder, and the vascular injection was accurately limited to the dilated portion. Kelling [108] thinks peritonitis may interfere with the action of the longitudinal muscle band controlling the cardia.

Braun and Seidel [141] think the cases of circulus vitiosus seen following a gastrostomy, gastroenterostomy, resection, pyloroplasty, etc., are due to an acute, or to an acceleration of a chronic, more or less severe grade of motor insufficiency and due to a direct or reflex injury of the stomach motility. In these cases there may be absence of vomiting and belching, although the stomach is over-filled with stinking material which can only be explained by a disturbance of the reflex apparatus.

Openchowski has decided that there are a number of centers in the brain and upper cord controlling gastric movements. From these centers both contraction and dilatation

fibres pass either by the vagi or by the spinal cord. Those passing by way of the cord leave the cord between the fifth and eighth dorsal vertebra and reach the stomach by way of the splanchnics. He says that less important nerve fibres go from above the 2d. dorsal ganglion by way of the sympathetic to the cardia. The automatic ganglion of the stomach is connected with the termination of these nerves.

Legueu [169] and Reynier [170] believe that acute dilatation of the stomach, often seen after operation on the kidney, is due to injury or irritation of the solar plexus nerve branches and liken it to the paralysis of the bladder produced by dilatation of the anus where we have the irritation or injury of the filaments of the hypogastric plexus.

Other evidence in favor of the view that acute dilatation of the stomach is due to an innervation disturbance is that Carion and Hallion [191] have shown that section of the pneumogastric nerves in dogs leads to dilatation of the stomach and to symptoms in many cases resembling those of uremia, probably due to the absorption of toxins from the stomach as in gastric tetany. Pavy [62] has shown that cutting both vagi in dogs may cause a paralysis and dilatation of the œsophagus as well as of the stomach.

Stieda's [111] experimental work on dogs is of special interest for he showed that section of both vagi of an animal two months after a gastroenterostomy posterior had been performed led to acute dilatation of the stomach with retention of dark brown or greenish fluid, even though the gastroenterostomy opening was large enough to admit the little finger.

Some light is thrown on this subject by the interesting series of experiments conducted by Cannon and Murphy.[192] They showed by the X-Ray-Bismuth method of examination that after handling the stomach and intestines even gently and within the peritoneal cavity, or under warm salt-solution, no gastric peristalsis was seen and no food left the stomach for three hours. Fingering the stomach and intestines gently in the air caused a still greater retardation of the move-

ments of food and with rough handling in the air no food passed the stomach for four hours and then slowly and it was moved downward sluggishly by the intestine.

The belief that acute dilatation of the stomach is due to an innervation disturbance dates at least as far back as 1862 when Brinton [127] clearly explained this gastric nerve disturbance in two cases of typhoid, which disease caused injury of the sympathetic and cerebro-spinal centers, *i.e.*, the solar plexus and the pneumogastric were exhausted.

I believe that the clinical, pathological and experimental data are strongly in favor of acute dilatation of the stomach as being primarily an innervation disturbance, affecting either the centers in the brain or cord or the nerve paths connecting the stomach with these centers.

Traube believed a gastric ulcer could produce the condition by affecting the nerve-end organs.

In support of this explanation I am able to name not less than twenty-seven writers on this subject, including those who have given the matter the most consideration and who have done the best experimental work.

Many other causes, some quite theoretical, have been given for the occurrence of acute dilatation of the stomach.

In favor of a simple primary or essential weakness of the stomach we have the names of Andral, Stieda, Lietaud, Majendie, Duplay, Hanau, Skoda, Rosenback, Poensgen and von Herff.

While Kussmaul [70] showed fatty and colloid degeneration of the muscle fibres in cases of chronic dilatation, this change has not been found in acute dilatation of the stomach, but instead, chiefly the separation of fibres due to the stretching and thinning.

Kussmaul [70] called attention to the possibility of a chronically dilated stomach causing, by its weight pressing on the horizontal limb, a complete closure of the duodenum and a superimposed acute dilatation. He also thought that a chronic dilatation may reach a point where the pull on the more fixed part of the pylorus might cause a kink of

the pylorus and an acute dilatation of the stomach results. He has shown by over-loading the stomach of a cadaver that there is a displacement of the stomach downward and a kinking of the duodenum at the point where the slightly fixed horizontal part joins the firmly fixed vertical part. The injection of a great quantity of fluid into the stomach caused kinking at this point followed by great dilatation of the stomach and of the duodenum above this obstruction. If more fluid was injected a bursting of the duodenum, not of the stomach, occurred. He thinks that the vomiting following the overloading of some stomachs is likely due to a closure of the duodenum, which is again rendered patulous by the vomiting and reverse peristalsis.

Boas [94] thinks that even an acute dyspepsia can cause an acute dilatation of the stomach and likens it to Frantzel's "Acute Ueberanstrengung des Herzens," and suggests the name "Acute Ueberanstrengung des Magens."

Stieda [31] believes the primary cause of the dilatation is an acute increasing atony of the stomach and of the duodenum.

Albrecht [1] thought an acute dilation of the stomach might be engrafted on a chronically dilated stomach that suddenly lacked sufficient muscle tone to overcome the obstruction and that the dilated cecum and ascending colon occasionally found are due to kinks made by the dilated stomach pushing down the transverse colon.

Kelling [108] says there must be a primary over-distension of the stomach which compresses the small intestine into the pelvis and calls the condition "combination ileus."

Whatever the etiology, the primary trouble is not the dilatation, but the motor insufficiency, which leads to the dilatation from the accumulation of gas due to fermentation and the retention of the ingested food and drink, together with the over-secretion.

Morris [180] thought the chief cause of the trouble was a hypersecretion of the gastric juice, which is almost always

present. Mahommed's [179] and Borchard's [164] cases also emphasize this point.

Kelling[108] mentions forcible compression of the abdominal walls by vomiting, or even by laughing (Schmorl's [110] case) as tending to displace the intestines downward and thus cause a kinking of the intestine or a compression of the duodenum by the root of the mesentery.

Spinal deformity or the application of a plaster jacket to correct such a deformity has been blamed for the occurrence of acute dilatation of the stomach in an interesting group of cases reported by Buzzard,[151] Kausch,[186] Kelling [108] and Willet [152] and others. The deformity present was a dorsal kyphosis due to Pott's disease in three cases. Other cases showed either a lumbar lordosis, a uniform kyphotic curve of the dorso-lumbar spine, a dorso-lumbar scoliosis or a rachitis dorsal kyphoscoliosis. An important practical feature of these cases is that five developed the acute gastric dilatation soon after being incased in a plaster jacket.

Schnitzler [85] thinks the increased prominence of the lumbar vertebræ in lordosis must facilitate the compression of the duodenum against the spine by the mesentery. Kelling [108] thinks that spinal curvature favors acute dilatation of the stomach by causing a more vertical position of the stomach and a displacement downward of the pylorus, which constrained position may be such as to immobilize the stomach. Kussmaul [70] says that the vertical position of the stomach, which is more frequent in women, may be either a remains of the fetal position or acquired from pressure of a corset or bands about the waist or displaced by a large liver. The pylorus may thus be displaced to the left and downward to or below the navel in a stomach of normal dimensions and this position necessarily favors dilatation.

Ptosis of the abdominal viscera with relaxation of the belly walls has been considered a causative factor by many (Glénard,[87] Robinson [46] and others). They think that the low position of the stomach favors dilatation and a pyloric kinking, and the relaxed belly walls causes a prolapse of

the intestine into the true pelvis and may cause kinking of the duodenum or a mesenteric compression. Bartels is supported by Bettman,[145] and others, in thinking that a floating right kidney may press on the duodenum and cause an obstruction of its lumen sufficient to produce an ileus.

It is possible as some have thought that a contraction or spasm of the duodenal sphincter fibres as described by Ochsner [156] may be the precipitating cause of the dilatation. It is not uncommon at operation on the gall bladder to find the duodenum dilated with or without a gastric dilatation. Davis [65] has shown by the X-Ray-Bismuth method of examination that the duodenum in normal individuals may be markedly dilated perhaps due to the contraction of these fibres.

Müller [33] thinks the dorsal decubitus position before, during, and after operation, is the most important contributing cause of acute dilatation, as he thinks it favors the prolapse of the small intestine into the true pelvis. He thinks the purgation before the operation is a factor, for by emptying the bowels it is more easy for them to enter the pelvis. It is hard to see how a dorsal position would favor the prolapse of the intestine more than the upright or standing position, or why, if it was much of a factor, it does not set up the trouble more often.

Volvulus or rotation of the stomach seemed to have been a causative factor in the cases of Thomson [1] and Wiesinger.[176]

Fermentation of the gastric contents may be a cause, for it not only follows gastric stasis, but as Naunyn [175] has shown, may in itself cause a gastric motor insufficiency. Ehret [175] has experimented on himself by eating highly fermentable substances and thus produced a circulus vitiosus, *i.e.,* fermentation, gastric stasis, motor insufficiency and more fermentation.

The filling of the bursa omentalis by a pancreatic cyst or an abscess may cause an acute gastric dilatation. A large gallstone may act as an obturator in the duodenum and cause the dilatation.

(To be continued)

# UNILATERAL RENAL HEMATURIA DUE TO PYELITIS CYSTICA.*

BY IRVING S. HAYNES, M.D.,

OF NEW YORK,

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UNILATERAL renal hematuria may be due to many causes —as calculus, tuberculosis, new growths, etc.,—which are demonstrable before or at an operation, less often to some obscure condition not ascertained even during an operation and, in a few instances, the cause has not been found after the extirpated kidney has been subjected to careful microscopical examination.

Such instances of bleeding from apparently normal kidneys have been termed idiopathic or essential hematuria. These cases, however, on microscopical examination usually show some pathological condition sufficient to explain the hæmorrhage. The lesions most frequently present in this class of cases is one of isolated patches of chronic nephritis.

But in the absence of microscopic changes it is not safe to attribute to this cause all such cases of obscure bleeding. The following case which I wish to report furnishes some pathological changes not usually found in the so-called instances of "essential hematuria."

History of patient taken March 7, 1905. J. W., age 65; American; retired builder. Large strong man, apparently about 50 years of age, weighs 185 pounds. Has never used alcoholic beverages, smokes a little.

*Family History.*—Father died at 78, mother at 32 in childbirth. No "bleeders" or cases of Bright's disease, cancers, tumors, or "stones" in the bladder in family.

*Previous History.*—Forty-four years ago he had an attack of malaria and jaundice while with the army at Nashville, Tenn.

* Read at a meeting of the New York Surgical Society, December 11, 1907.

He was very yellow at this time, but had no attacks of pain. His skin did not clear up entirely for two years, and the effects of this attack lasted for several years. There were no symptoms, however, referable to the genito-urinary system.

Twenty years ago he had an attack of rheumatic sciatica. His general health has been excellent. He never has had any venereal diseases, in fact never had sexual intercourse until his marriage, when fifty years of age, to a strong healthy woman half his age. He has been very vigorous in his marital relations, and has three healthy children.

*Present History: Urination.*—In 1897 he began to notice that he had to pass his urine more frequently than usual. These attacks of increased frequency of urination at first lasted only a few hours, and would then pass off. They would return under stress of extra exertion, worry in business, excitement and loss of sleep. He began to get up to urinate during the night. Gradually the act of urination became painful, the pain seeming to run from the kidneys and the head of the penis to centre in the bladder. At present he urinates every hour or two if at rest, and not excited or worried, but every five to ten minutes if under mental strain.

At night he gets up from six to eight times, sometimes more. When under any nervous tension, he has a great deal of straining during urination with severe pain in the head of the penis. Cold sweat runs down his back. The urine comes in a gush in a good sized stream. He says it has never stopped suddenly.

*Pain.*—He feels at times pain in the small of the back—"like boring with an auger"—more on the left side, but it may extend over to the right side. The pain goes away on lying down. The pain shoots down into his scrotum and to the head of the penis, especially just before urinating, and is so severe that he has to squeeze his penis as hard as he can to ease it.

*Blood in the Urine.*—In the summer of 1903, after being forced to hold his water for a long time, he first passed bloody urine. This attack lasted twenty-four hours, when the urine cleared up after resting at home. Twice since then he has noticed two or three "strings of blood the size of a pin and one-half inch long" in the urine. Last summer, 1904, there was a small blood clot in the chamber. Bowels are quite regular.

His digestion is slow. Tongue is slightly coated at times. He has some soreness beneath the costal arch on the right side at times.

*Physical Examination.*—Temperature, normal; pulse, 84; arteries, soft. The heart and lungs are normal. The liver is not enlarged. There is no trouble with the gall bladder or ducts. The stomach is normal. The spleen is not enlarged. The intestines are not distended, nor sensitive, and there is no evidence of appendicitis. Neither kidney is sensitive or palpable. There is no tenderness over the course of the ureters, nor over the bladder. The external genital organs are normal. There is no stricture in the urethra. Residual urine measures one ounce; it is a little cloudy, but not bloody or ammoniacal. Specific gravity above normal. Trace of albumen.

*Rectal Examination.*—This shows only a good-sized prostate normal in feel and not tender.

In one month under urotropin, alternating with a mixture of hyoscyamus and infusions of buchu, the urine became clear, there was no residual urine left in the bladder, and his general condition improved so much that he did not report for several months, or until January, 1906, when he stated then that during August, 1905, one morning, after passing a quantity of clear urine, there followed about an ounce of bright blood. After this he passed bloody urine for a few days. An urinalysis made February 7, 1906, shows the following:

Odor, urinous; color, yellow; spec. gravity, 1.025; reaction, moderately acid; appearance, cloudy; sediment, small amount; quantity passed in 24 hours, 52 ounces.

*Chemical Analysis.*—Albumen, large amount; sugar, small amount; urea, 9 gr. per oz.; bile, none; aceton, none; indican, none; chlorides, normal; phosphates, normal.

*Microscopical Examination.*—Epithelium, few, round; crystals, none; amorphous deposits, none; blood, *large number corpuscles;* pus, large number leucocytes; casts, *hyaline;* mucus, large number corpuscles; fungi, none; spermatozoa, none; bacteria, none.

The irritation in the penis and soreness over the back is less, and his general health is better than one year ago.

I had several X-ray photographs made by Dr. L. G. Cole, of which the outlines are here given: Fig. 1, the right kidney;

Fig. 2, the left kidney; Fig. 3, the pelvic cavity. All viewed from behind.

The photograph of the left kidney shows that it is considerably enlarged. In the pelvis (photograph No. 3) in a region apparently close to the bladder, and in the course of the left ureter is a small dark round shadow. A tentative diagnosis of ureteral calculus was then apparently justified.

On March 9, 1906, Dr. Follen Cabot cystoscoped the patient for me, methylene blue having been previously given. Examination of the bladder showed that it was normal in all parts except about the left ureteral orifice. Here the mucous membrane was somewhat thickened and reddened.

A catheter was readily entered in the right ureter and passed to the pelvis. The orifice of the left ureter was entered after some difficulty owing to a ridge in front of it, and the catheter passed easily and without obstruction to the pelvis of the kidney. This demonstrated that there was no calculus in the ureter. The shadow in the photograph might have been cast by a calcareous lymphatic gland, a phlebolith, or some object in the rectum.

Examination of the urine from the left kidney was made by Dr. T. W. Hastings, who reported as follows:

Urine, blue, after methylene blue, faintly cloudy, few fine flakes. Albumen, a trace.

Microscopic: Many large cells, single and in masses; few leucocytes; many blood cells; few squamous cells from genito-urinary tract. Stained after hardening. *Cells in masses show structure, suggesting neoplasm, particularly papillomatous tissue.*

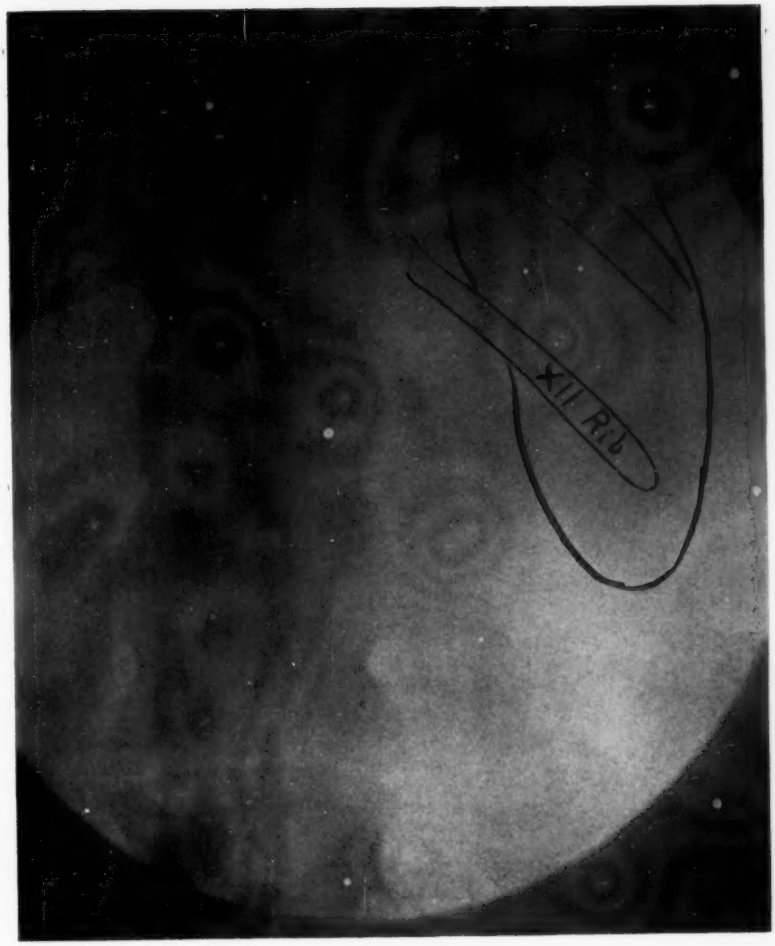
At this date, as the patient was indisposed to have any operative work done—as the evidences of a papillomatous growth in the kidney was very inconclusive, as his general health was good and his urinary symptoms not urgent, and he was enjoying a fair degree of comfort from internal medication, I did not urge operative treatment. He reported once or twice a month for observation.

On November 5, 1906, an urinary analysis by Dr. Hastings is as follows:

Appearance, cloudy; color, normal; reaction, acid; acidity, normal; specific gravity, 1015; urea, 2.5 per cent.; indican, increased; albumin, trace, marked; glucose, none; diazo, none.

Sediment.—Amorphous, none; crystals, none; epithelium,

FIG. 1.




Right kidney. From behind.

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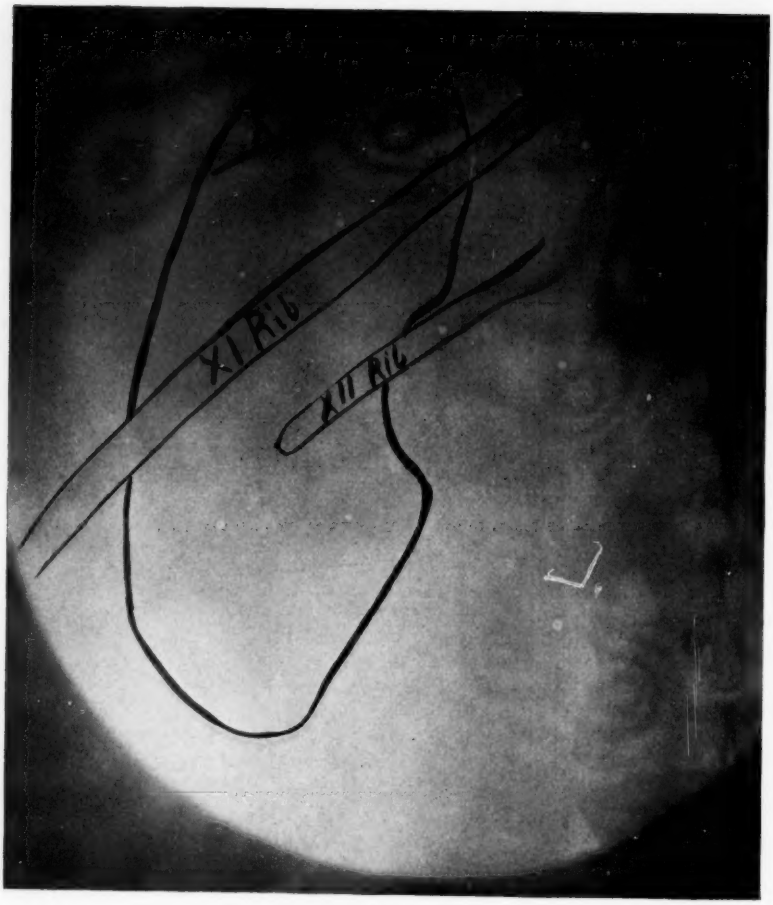
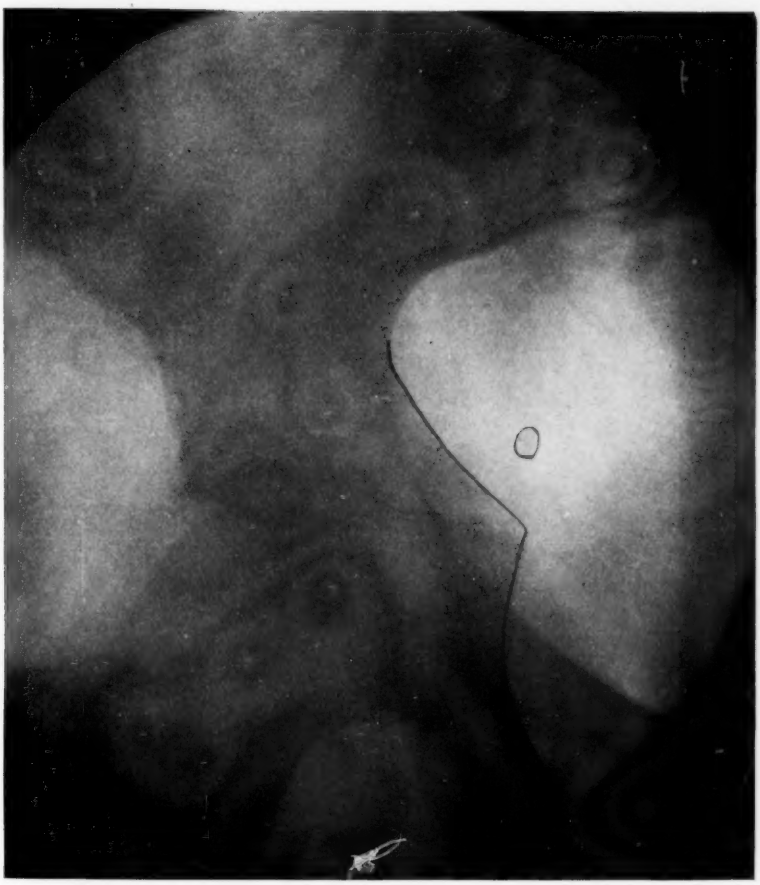
FIG. 2.




Left kidney. From behind.

FIG. 3.



Left side of pelvic cavity. From behind.

large and small round cells numerous; casts, none; red blood cells, numerous; leucocytes, numerous.

Remarks.—Tissue cells not found. Tubercle bacilli not found.

April 5, 1907.—The patient reported to-day. He has lost 25 pounds in weight but has been fairly comfortable until within the past two months. Since then he has frequently passed bloody urine, not in large amounts, but more often, so that for the urine to be clear is the exception. The pain in his left flank has been more constant. It is located just to the left of the lumbar spine, though there is no tenderness on pressure here or elsewhere in the abdomen.

The desire to urinate has increased in frequency and become more imperative. Unless he attends to the call at once, he often urinates in his clothes.

The medicinal treatment seems to have lost its effect. He was so wearied with his present condition that he wished something done.

April 9, 1907.—Dr. Follen Cabot made a second careful examination of the bladder. About the left ureteral opening and reaching to the middle line, the mucous membrane was inflamed and swollen, and the vessels injected, and the area red and angry looking. There were no growths; the prostate was not pathologically enlarged.

Urinary examination from the bladder by Dr. Hastings shows:

*Examination of whole Urine.*—Date, April 10, 1907. Appearance, faintly cloudy; color, normal; reaction, acid; acidity, normal; specific gravity, 1012; urea, 1.76 per cent.; indican, none.

Sediments: Amorphous, none; crystals, calcium oxalate; epithelium, few squamous cells; casts, none; albumin, trace; glucose, none; red blood cells, numerous; leucocytes, numerous.

Remarks.—Albumin present, red cells and leucocytes numerous, no fixed-tissue cells found.

From the right kidney by ureteral catheter: Albumin, none. Sediment: Amorphous, none; crystals, none; epithelium, few squamous cells; casts, none; red blood cells, none; leucocytes, none.

Remarks.—Specimen by catheterization of ureter normal microscopically.

From the left kidney by ureteral catheter: Date, April 14, 1906. Appearance, cloudy; color, pale yellow; reaction, acid; acidity, normal; specific gravity, 1016; urea, 1.9 per cent.; indican, trace, normal; albumin, trace.

Sediment.—Amorphous, none; crystals, none; epithelium, few squamous cells; casts, none; red blood cells, moderate number; glucose, none; leucocytes, numerous.

Remarks.—Single epithelial cells, large and small, no cells suggesting new growth as in former specimen.

The diagnosis was in doubt. Whatever the lesion, it was located in the left kidney.

Calculus could be ruled out from the character of the hemorrhages, the absence of renal colics, the negative X-ray findings. Tuberculosis was not probable as no T. B. had been found in repeated urinary examinations; the absence of foci elsewhere, and the general good health of the patient. Malignant growth could be excluded as no tumor could be felt and the long duration of the disease without cachexia made its existence seem very improbable.

The only positive evidence we had to depend upon was the presence of the posterior kidney pain, the irregular and intermittent hemorrhages and the finding with the microscope of "cells in masses (which) show structure suggesting neoplasm, particularly papillomatous tissue," which Dr. Hastings had noted a year previously. The most reasonable conclusion was then that there was some benign pathological process in the pelvis of the left kidney, probably a vilous papilloma. Operation was undertaken April 13th, with the assistance of Drs. Fletcher and Boynton. An external perineal section was first done, chiefly to drain the bladder, secondarily to deplete the prostate. A skirted cannula was inserted into the bladder and the wound packed.

Next the left kidney was exposed through a six-inch oblique incision, the twelfth rib requiring section.

The perirenal fat was excessive and in many places was adherent to the kidney capsule. It was stripped off and the kidney delivered through the incision without undue tension on its vessels.

It was large and presented the characteristic fœtal lobulated appearance in a marked degree, but otherwise seemed normal. Nothing was seen or felt from the exterior.

The cortex was then split to the hilum, and a digital examination found nothing. The question what to do next I solved by removing the kidney for it was clearly the seat of some irritation that produced the hematuria. The cure of this condition in our ignorance of the cause of the hematuria without a nephrectomy was problematical, the operation was being performed for the sole purpose of relieving our patient, and we knew the right kidney was working normally.

The removal of the kidney was accomplished without especial difficulty, though there were two large arteries—one to each pole besides the normal renal vessels. These, the other vessels and the ureter were ligated separately.

The muscles were sutured with No. 3, 40 day, chromic gut, and the skin with No. 2, 10 day, chromic gut continuous sutures about a small cigarette drain.

What started out to be a smooth convalescence was interrupted on the third day by the unfortunate breaking of the muscular suture followed by free oozing from the wound and severe shock to the patient. With the assistance of Drs. Connors and Moorhead, the wound was reopened and masses of blood clots scooped out. No bleeding points were visible, but there was a slight oozing from the entire surface of the perirenal fat.

The region was packed moderately with iodoform gauze, the muscles closed with interrupted No. 3 chromic gut sutures, and the skin with a No. 2 continuous suture up to the gauze wick.

The case progressed so far as the wounds were concerned satisfactorily, and the gauze was gradually removed in the course of the week.

In a month the patient left the sanatorium with a small perineal and lumbar sinus. A report of the urine, one week after the first operation, shows that there was 48 ounces passed in the twenty-four hours without kidney elements, and containing 15 grains of urea per ounce.

The strain of the second operation upset the patient's mind for ten days, so that, while usually rational by day, at night he was quite delirious and unable to sleep.

After trying various sedative hypnotics with hardly any effect, I finally stopped them all, gave the patient a pint of beer every night, and he quieted down, slept well and began to gain.

THE EXAMINATION OF THE KIDNEY.

Macroscopically, it was enlarged, deeply lobulated, but presented no naked-eye evidences of disease in the kidney tissue proper or in the pelvis. I concluded I had removed a normal organ. However, after hardening the specimen in a 2 per cent. solution of formaline, I examined the kidney again and was surprised to find that the mucous membrane over the entire pelvis of the kidney showed a very fine villous surface with small dark spots here and there.

MICROSCOPICAL EXAMINATION OF KIDNEY—CASE OF RENAL HEMATURIA.

By Dr. James Ewing.

"The organ shows a moderate grade of chronic productive nephritis, with thickening of the stroma in many *patches,* and general arteritis. *The tubules and cells are practically normal.* The whole organ is in a state of chronic venous congestion, as shown by the dilatation of large veins and distention of glomerular capsules. *The pelvis shows the lesions of long standing pyelitis.* The epithelium is disordered, in places thickened, at other points thinned. The basement membrane is irregular and often deficient, the epithelium lying upon a layer of dense hyaline connective tissue. At many points the epithelium has become invaginated into the subjacent tissue, yielding islands of isolated epithelium similar to those seen in early stages of *pyelitis cystica.* At some points the new connective tissue shows many new arterioles, but it is usually non-vascular. Numerous extravasations of blood are to be found beneath the pelvic epithelium, in the fat tissue, and in and about the dense connective tissue supporting the epithelium. No dilated veins are seen in the pelvic mucosa. Two possible sources of hemorrhage are to be found in this case:

"1. The chronic venous congestion of the whole kidney.

"2. The superficial chronic inflammation of the pelvic mucosa, which has produced many new but poorly formed vessels.

"The exact points of origin of the hemorrhage were not discovered."

*Subsequent History.*—November, 1907. His general health is good. The perineal incision healed in the course of two months. A lumbar sinus exists three inches deep. It discharges a little muco-pus in the course of two or three days sufficient to stain through four layers of gauze. Blood, in a very slight amount, has appeared in the urine first passed after the use of sounds (No. 18 English) on two occasions, but there has been no return of the old condition. He still has a contracted bladder

and chronic cystitis with frequent micturition for which he is under treatment at present. But there is no residual urine.

He has no pain unless he attempts to hold his urine too long. This is more of a " sore feeling " in the bladder and penis.

The prostate is not enlarged (the left lobe is somewhat smaller than the right), it is not tender to pressure, the urine examination by Dr. Ewing is as follows:

November 6.—Appearance, cloudy, faint yellow; reaction, slight alkaline; specific gravity, 1015; albumin, slight nucleo-albumin, small amount serum albumin.

Sediment.—Moderate; crystals, none; epithelium, many flat; casts, none; red blood cells, good many; leucocytes, many.

Remarks.—Appears to be urine of chronic cystitis. Many bacteria present. Very little mucus. Leucocytes in clumps, epithelia hydropic.

How may the course of events in this case be explained?

First.—The man marries late in life and is very active sexually at the same time " withdrawing " to prevent conception. This leads to a chronically congested condition of his whole genito-urinary system, particularly his prostate and bladder, marked by frequent and painful micturition.

Second.—There was an occasion of forced retention of urine followed by a free bleeding for a short time. This might mean that the lesion causing the hematuria was in the bladder or in the left kidney. If in the latter the urine might have damned back into its pelvis and the lesion been located there.

Third.—Wherever the lesion was situated it doubtless furnished the atrium for an infection which has since persisted. In the kidney it was sufficient to cause an obstinate hematuria, and in the bladder it still requires active treatment.

It is idle to speculate whether the condition was primary in the kidney or bladder. However, in view of the fact that the right kidney was not affected; that the infection if extending from the bladder would be likely to involve both kidneys and that the second cystoscopic examination showed a decidedly more extensive and active cystitis about the left

ureteral orifice, than had existed at the first examination one year before, I am disposed to think that the "infectious" process began in the left kidney and extended to the bladder, although the latter was in a state of chronic congestion before this occurred.

Fourth.—The infection in the left kidney eventually developed into a chronic pyelitis as shown by the presence of pus and blood cells (microscopic examination). The final condition has already been described by Dr. Ewing, and he calls the lesion a "pyelitis cystica," *i.e.*, similar to the pathological changes found in cases of chronic cystitis.

Fifth.—The changes in the stroma of the kidney (its essential structure not being involved) were probably brought about as a result of chronic congestion of the organ caused by obstruction to the outflow of urine from the kidney, and to the inflammation of the mucous membrane of the pelvis of the kidney and bladder (about ureteral orifice).

The changes in this kidney seem to be quite different from those mentioned as present in kidneys apparently normal that were removed for persistent hæmorrhage. In those cases the usual histological findings have been scattered areas of chronic nephritis involving the tubules or glomeruli.

In only two instances in the reported cases which I have read do I find the hæmorrhage apparently caused by pathological changes in the mucous membrane of the pelvis of the kidney.

One is reported by MYLES of the case of a woman twenty-six years of age from whom the left kidney was removed after an antecedent nephrotomy had been performed without relief of the hematuria. On histological examination diffuse myxangiomatous change was found in the submucous tissue of the pelvis of the kidney, while the tissues of the kidney were the seat of but slight changes.

The mucous membrane of the pelvis was probably in a state of so-called pyelitis cystica.

The other is by KEEFE of a farmer, 38 years of age, not a bleeder, whose history dated back six years, when after a cold he had frequent and painful micturition with hematuria. The attack lasted two months. Three years later he again noticed blood in his urine as small streaks. The bleeding increased in amount to the present time. The blood is

bright at times, at others clotted. He lost thirty-five pounds during the last year.

The urine is red; specific gravity 1029: Alkaline: Large quantity of blood found by microscope. The cystoscope showed the left ureteral orifice red, swollen and pouting. The rest of the bladder was normal. A specimen obtained from the left ureter by catheter showed numerous blood cells, but no casts. The X-ray was negative. There was a dull aching pain over the region of the left kidney.

The kidney was exposed, palpated, incised and probed; nothing was found. Although it appeared normal it was removed.

Microscopical examination of the kidney showed only several small reddish injected areas in the pelvis. By the microscope some extravasation of blood into the substance of the kidney beneath the cortex was found. The cause of this condition was not evident. In sections of the pelvis a few areas of extravasated blood into the tissues were found. The patient recovered and six months after the operation was apparently perfectly well. The clinical history of this patient is strikingly like the one I have reported, while the gross pathological findings parallel it closely. The histological report is not full enough to warrant any conclusion, although, here also the two specimens seem considerably alike. Evidently there is not much doubt but that the pelvis was the seat of the hemorrhages.

## "IDIOPATHIC RENAL HEMATURIA."

A brief review of the essential features of this obscure form of renal bleeding may not be out of place.

*Synonyms.*—Under the general terms of idiopathic renal hematuria may be grouped all those cases formerly classified as essential, hemophilic, angio-neurotic, hysterical and neuralgic renal hematuria, and renal hæmorrhage without lesions.

With the exception of angio-neurotic hematuria and renal hemophilia this classification of hematuria without gross lesion in apparently healthy kidneys has become practically obsolete since such kidneys have been subjected to careful microscopical examination.

*Etiology.*—As mentioned before these kidneys under the microscope usually show some definite lesion. This in the majority of cases is a condition of chronic nephritis in small isolated areas, involving the tubules or glomeruli or both. As an additional cause I would like to add a chronic lesion of the mucous membrane of the pelvis of the kidney, designated pyelitis cystica. However, there are a few in-

stances recorded in which a careful gross and minute examination has failed to show any change whatever to account for the hematuria, and hemophilia being excluded we must conclude with Schede that the only explanation is by accepting the theory of angio-neurosis. This explanation is, however, clearly begging the question, and it would be just as well to admit that in these cases we do not know what is the underlying cause. The cause which starts the train of pathological changes in the majority of cases is probably an infection which reaches the kidney or its pelvis through the blood or from the bladder. However, only a small number of the cases of patchy nephritis or chronic pyelitis bleed.

The cause of the bleeding is unquestionably some disturbance in the blood supply to the kidney in whole or part, as displacements, changes in body temperature (taking cold), an over-distended bladder, embolism, thrombosis, and other more easily understood causes as calculus, tuberculosis, new growths, traumatism and parasites.

*The quantity of blood lost* may vary from a few blood cells discovered in the urine only by the microscope, to such a profuse outpouring as to endanger the patient's life. It may occur intermittently at long or short intervals, or be practically continuous. There is no special character to it to definitely distinguish it from bleeding due to other causes in the kidney. There is nothing about the hematuria to definitely locate its source, as in the kidney, ureter, bladder, or prostate. However, if the blood is thoroughly mixed with the urine, and if there is the passage of thread-like clots, the source of the bleeding is probably in the kidney.

*Symptoms.*—The only positive symptom is the presence of blood in the urine, and the demonstration that it comes from but one kidney. There may be pain but usually this is not present unless the kidney is congested (or distended) and its capsule stretched (as the only sensitive nerves of the kidney are supplied to the capsule). It is located behind in the costo-vertebral angle, and is described as a boring pain.

An attack of renal colic from the passage of blood clots

will present the usual symptoms and help to localize the source of the hematuria.

*Diagnosis.*—By means of the cystoscope and ureteral catheterization the diagnosis of unilateral renal hematuria is usually not difficult. But without direct inspection of the ureteral orifices and the use of the catheter the location of the hæmorrhage is uncertain. Nothing can be absolutely predicted as to its source from an examination of the urine, and the various segregators are unreliable; there are too many opportunities for error.

By means of the cystoscope, ureteral catheter and the posterior kidney pain, the source of the hæmorrhage having been located in one kidney, the determination of the cause is the next problem.

The conditions which may give rise to a hæmorrhage from one kidney are commonly calculus, tuberculosis, malignant disease or movable kidney.

1. The most common is calculus. A renal colic, the passage of sand or calculi in the urine, a photograph by the X-ray showing a dark shadow in the kidney make the diagnosis almost sure but blood clots may cause colic, calculi may come from the bladder or be intentionally put into the urine, and a pure uric acid stone throws no shadow under the X-ray.

2. Tuberculosis may be concluded on finding the " T. B." in the urine, or by innoculating experiments, by finding tubercular foci in other parts of the body and from rapid loss of weight. Yet at times a small circumscribed tubercular lesion can exist without giving any evidence of its presence other than by the bloody urine.

3. A malignant growth attended by the tumor and cachexia may be plain, but if present to this degree the case is hopeless for surgical intervention, and earlier diagnosis may be absolutely impossible if no cancer cells are found in the urine. A severe cachexia not unlike that of malignant disease may be present from excessive loss of blood, and a tumor may be felt that is benign in its nature but which is causing the hematuria.

4. If no other condition is found except that the kidney is abnormally mobile this may be the true cause.

5. Hematuria from a renal hemophilia would furnish evidences of this condition in the family or personal history of the patient.

There is such a strong element of uncertainty present in all the foregoing conditions that positive conclusions cannot be safely drawn until the kidney is exposed and subjected to direct examination. If then the diagnosis in such apparently obvious conditions is in doubt previous to operation, it is much more so in the class of cases to which the one here reported belongs.

By excluding the foregoing conditions, by finding blood, albumin and casts, or in the absence of blood only albumin and casts in the urine from one kidney and not the other, we may conclude that the former kidney is the seat of a chronic nephritis, probably in disseminated patches. When blood is present in the urine the reaction for albumin is, of course, obtained. In order then to ascertain the existence of an independent albuminuria, the amount of hemoglobin and albumin must be determined and comparing these an excess of albumin over the proportion of 1.6 to 1 hemoglobin points not only to an independent albuminuria but also to a renal affection as the cause of the hematuria (Newman). I do not think it is necessary to repeat here the evidence that unilateral localized nephritis may exist, and that this condition is sufficient to explain the hematuria. These facts seem well established. Furthermore the evidence here furnished shows that there may also exist a kidney with normal tubules and glomeruli, and with apparently a normal pelvic mucous membrane (to naked eye inspection) which however, is the seat of chronic inflammatory changes sufficient to cause the hematuria. Of course the proof that these lesions are limited to one kidney (and that the kidney removed is the only one affected) is incomplete. But so long as the urine from the other organ contains no kidney elements we may conclude that the lesion was unilateral.

*Treatment.*—If we were certain of our diagnosis the treatment of so-called "idiopathic" renal hematuria would be comparatively simple. But we are not sure even with the kidney exposed, split open and its pelvis exposed to view, because the lesion may be found only after prolonged microscopical examination.

The treatment may be expectant or operative. Internal medication should be tried in all cases of mild hematuria when calculus, new growths and tuberculosis can be excluded. This may be supplemented by direct irrigation of the pelvis of the kidney through the ureteral catheter with a solution of adrenalin (Young) or mild antiseptics. This treatment, while curative in traumatic renal hematuria, would hardly be effective in the class of cases we are considering. It is, however, worthy of a trial.

In patients growing progressively worse under internal treatment, if pain is present or infection exists, the treatment must be operative. Surgeons are then compelled to expose the kidney. Direct inspection may clear up the diagnosis. If the kidney is "puckered, scarred, and mottled in color, irregularly or more or less toughly adherent to the surrounding tissues in places, some parts of its parenchyma look pale and yellow whilst for the most part it is deeply congested and the knife meets with different degrees of resistance" (Morris) we may conclude that the organ is the seat of a chronic nephritis. Nephrectomy should not be done as the other kidney may be similarly affected. Decapsulation after the method of Edebohls, or decapsulation with transference of the organ into the peritoneal cavity as suggested by Bakes is all that should be attempted.

For hematuria due to movable kidney nephropexy is indicated; due to a congested and inflamed kidney decapsulation is sufficient; with infection present in the kidney in addition to nephrotomy the organ must also be drained; with a chronic (microscopical) pyelitis one would expect that long continued drainage after nephrotomy might be curative. If circumstances permit after a nephrotomy discloses an apparently

normal kidney, while the operation is arrested for a few minutes, a microscopical examination of a small section from the kidney might indicate the proper course to pursue. In certain cases all of these operations have been successful and in others all but nephrectomy have failed to arrest the bleeding.

If the conditions in the tissues surrounding the kidney, if the state of the capsule or the kidney itself does not afford a fair inference as to the cause of the hematuria; if the symptoms of hematuria, pain and disability, have been steadily increasing under persistent medical treatment; if the other kidney has been proved to be sound; and if the patient and surgeon are not prepared to undergo a possible secondary nephrectomy, the kidney should be removed, because the lesion in such obscure conditions may be chronic pyelitis or a true form of angio-neurosis which are amenable only to the more radical operations.

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# TRANSACTIONS

OF THE

# NEW YORK SURGICAL SOCIETY.

*Stated Meeting, November 27, 1907.*

DR. WILLY MEYER in the Chair.

## FUNCTIONAL RESULT AFTER AMPUTATION OF THE BREAST.

DR. ELLSWORTH ELIOT, JR., presented a woman 35 years old who was operated on June 26, 1906, at the Presbyterian Hospital for a carcinoma of the right breast. The history she gave on admission was that she had one child four years ago which she had nursed for 18 months. About six months ago she noticed a small lump in the right breast to the inner side of the nipple. This gradually increased in size, and as it was regarded as a fibroma, it was removed in the dispensary. Upon microscopic examination the growth proved to be a carcinoma, and the patient was sent to the hospital for a radical operation. This was done by the Meyer-Halsted method, and the patient left the hospital July 6, 1906. The functional result of the operation was practically perfect, all the usual movements of the arm being unimpaired.

## SPLENECTOMY FOR RUPTURE OF SPLEEN WITH SUBSEQUENT CHOLECYSTECTOMY.

DR. ELLSWORTH ELIOT, JR., presented a woman thirty-four years of age, who was one of two cases of subcutaneous rupture of the spleen that were reported by Dr. Eliot at the last meeting of the American Surgical Association, and published in detail in the *New York Medical Journal* for July 13, 1907. The history of the case was as follows:

Eight years ago patient was curetted for retained secundines; four years ago she was operated upon for ruptured ectopic gestation sac, in a condition of almost complete exsanguination. Since then she has been in excellent health.

On May 14, 1906, at ten o'clock, patient fell a distance of nine

feet, striking the region of the lower ribs against the edge of an ash can. She was unable to rise, and there was severe pain in the left side intensified by movement and by deep respiration. To lie on her left side was impossible, and lying on her back was also painful. There has been no vomiting. The pain seemed to diminish for a time and then returned with increasing severity, and the patient began to feel weak and thirsty. She was brought to the hospital in an ambulance.

Five hours after the accident the pulse was regular, 132, and of low tension. The respiration was shallow and increased in frequency. There was a fracture of the eighth and ninth ribs near the axillary line. Examination of the abdomen showed a diminished respiratory movement on the left side. Rigidity, present throughout the entire left side, was most marked in the ileocostal space and over the left lower costal arch. Moderate pressure over the splenic area was very painful. In the left flank there was dulness merging with the area of normal splenic dulness above. Elsewhere the percussion note was unchanged. The patient was acutely anæmic and presented the usual appearance of a patient suffering from internal hemorrhage.

Splenectomy was performed six hours after the accident under nitrous oxide gas and ether. A vertical incision was made along the upper outer border of the left rectus above the level of the umbilicus extending from its upper extremity downward and outward along the costal margin a distance of four inches. A considerable amount of clotted and fluid blood was found in the peritoneal cavity and rapidly evacuated, disclosing the spleen with a deep rupture two and one-quarter inches long on its internal surface in front of the hilus and on its outer surface, denuded of its peritoneal coat, an irregularly circular orifice three quarters of an inch in diameter communicating with the larger rent internally. The spleen was double the normal size, and was still bleeding. The pedicle was clamped with two strong forceps, and the spleen removed. The remaining clotted blood was then quickly washed away with saline irrigation, and after the insertion of a cigarette drain to the pedicle the wound was closed, leaving an aperture at its lower extremity for the handles of the clamps. The duration of the operation was twenty-one minutes, and at its end, the pulse being 140 and weak, an infusion of 1,200 c.c. of saline solution was given.

During the following night the pulse was at times almost imperceptible and there were several attacks of vomiting, but the patient responded well to stimulation, and at the end of twenty-four hours was in very satisfactory condition. The clamps were removed at the end of forty-eight and seventy-two hours, respectively. The healing of the wound was satisfactory, although there was a gradual rise of temperature to 103° F. on the fourth day and a continuation of a temperature averaging 102° F. until the fourteenth day, when it fell to normal. On the nineteenth day there was a sudden rise of temperature to 102° F., with the physical signs of fluid in the left chest. At the end of ten days the temperature was again normal and the signs of fluid had entirely disappeared. The patient was discharged in excellent condition at the end of the forty-fifth day.

Since her discharge from the hospital, patient has had several attacks of "indigestion" with pain of moderate or slight severity in the gallbladder region. About forty-eight hours before the second admission, and ten and a half months after splenectomy, she was seized with sharp severe pain in the same region, which radiated to the back, although not to the shoulder, and was intensified by movement from one side to the other in bed and by respiration. There was constant nausea, but only one attack of vomiting on the afternoon of the day of admission, the vomitus consisting of the gastric contents. The bowels had moved each day. The prostration was marked, and at the time of admission the pulse was 110, the temperature 102° F., and respiration 44. The patient looked acutely sick, and the pain was then very intense and prohibitive of any movement in bed.

On examination the patient was in the dorsal position, with the thighs flexed on the abdomen. The right side of the abdomen was held rigid and motionless, and was exquisitely painful to the touch. There was intense rigidity of the upper part of the right rectus and to a lesser extent of its lower portion as well. There was well marked resistance of the upper part of the right costal arch and pressure over the arch above the situation of the gallbladder caused pain. The extreme tenderness prevented satisfactory percussion. Under a general anesthetic the gallbladder could be distinctly felt projecting below the border of the liver to a point opposite the level of the umbilicus and forming an oval, smooth and deeply elastic tumor.

The operation was performed under nitrous oxide gas and ether. Through a vertical incision parallel to the upper outer border of the right rectus muscle, the peritoneal cavity was opened and the gallbladder exposed with the transverse colon and omentum moderately adherent. There was a small amount of clear serous fluid in the peritoneal cavity. The gallbladder was double the normal size and its wall stretched and elastic. It was rapidly and easily separated from the liver above, and after ligation of the edge of the gastrohepatic omentum, and cystic duct with chromic gut was cut away without its cavity being opened. On opening the gallbladder its cavity contained a considerable amount of turbid serous fluid, its walls were thickened and œdematous, and near the orifice leading into the cystic duct were two large calculi. The immediate reaction after the operation was satisfactory but by the third she had fallen into a condition of coma from which she could not be roused, with a temperature of 103° F. and a pulse between 130 and 148; leucocytosis 55,000; polymorphonuclears 90 per cent. Abdominal distention developed together with a fistula discharging freely a yellow-brown material. No muscular rigidity or sign of fluid in the peritoneal cavity. The condition grew steadily worse, until by midnight of the fourth day, it became most alarming and the patient appeared moribund. In an effort to check what appeared to be a form of toxine absorption, lavage was given followed by catharsis with colon irrigations. At half past two in the morning patient appeared for the first time to be holding her own, and soon after began to show a continued but manifest improvement in that the pulse became slower and stronger, and the saline enemata brought away each time quantities of foul fecal material with a considerable amount of flatus. The temperature also gradually fell to 102° F. The coma continued without change and the pupils were still dilated. The condition of the abdomen showed no sign of peritonitis.

Fifth day: Toward noon the coma decreased and the patient seemed to be slightly conscious of her environment. Following a clysis patient had a chill, with a rise of temperature to 105° F., but by night the temperature had again fallen to 102° F. Late in the afternoon patient began to moan and could be aroused by effort. Although always in a very stupid condition, yet on several occasions she asked for water. Her entire condition showed

great improvement, and during the day she was given 48 ounces of fluid nourishment. During the morning the right pupil was slightly larger than the left, but later on both were equal and contracted. This afternoon the pulse was as low as 90.

Sixth day: Patient talked at intervals during the day, and said that she remembered nothing of what had transpired since the operation. The mind was quite clear, and she took increasing quantities of fluid nourishment. Patient looked much stronger, the temperature was as low as 100° F. and the pulse in the 80's. The abdominal condition was unchanged. There are still many subcrepitant râles over the left base as well as over the right base, although less abundant. On this day, although the biliary fistula was discharging freely, the conjunctivæ and skin became slightly icteric and the urine showed the presence of bile. Several cultures of the blood failed to disclose any organism.

Subsequent course: The patient continued to gain ground steadily. The jaundice, at first somewhat deepened, had by the end of a week entirely disappeared. The temperature remained, however, irregularly and persistently high, varying between 99° F. in the morning and 102° F. at night. During this time, the pulse varied between 94 and 115, being usually slightly over 100. On the twenty-sixth day, signs of a small amount of fluid were detected by Dr. James over the right base and about one drachm of slightly purulent fluid was withdrawn by the needle. On the following day the temperature rose to 103° F. and the pulse to 140, and immediate thoracotomy was performed under cocaine, evacuating a very small amount of pus. After the operation the patient was restless and somewhat neurasthenic, but never at any time showed any distinct manifestation of hysteria. The discharge from the opened pleural cavity was always small, and after the removal of the tube rapidly healed to a small sinus, with excellent expansion of the lung. For more than two weeks the patient had an irregularly high temperature, but since that time the temperature gradually fell to normal.

## SPLENECTOMY FOR RUPTURE OF SPLEEN.

Dr. Ellsworth Eliot, Jr., also presented a boy of thirteen years, who was admitted to the Presbyterian Hospital on June 10, 1907. On the morning of that day he was run over by an

express wagon, a comparatively narrow wheel passing over the abdomen from left to right. The patient was immediately unconscious, and was brought to the hospital in an ambulance. Shortly afterwards he became conscious and complained of pain in the left hypochondrium, sharp in character and of gradually increasing intensity. On examination, there was tenderness and moderate rigidity over the entire upper segment of the abdomen, slightly more marked on the right than on the left side. The patient was in moderate shock, the pulse being 73 and weak. One hour later the pulse was 80 and the patient was beginning to be restless. Six hours after the accident and just before operation the patient had become acutely anæmic, the pulse had increased to 140, and on physical examination dulness was found in the left flank, with marked resistance over the lower part of the left costal arch. There was still some rigidity in the upper right quadrant of the abdomen.

Owing to the possibility of rupture of both the liver and spleen, an incision was first made in the median line above the umbilicus, to which was later added an oblique incision along the edge of the costal arch. On opening the peritoneal cavity a large amount of semi-clotted blood escaped. The liver was found to be intact. The spleen was almost bisected through the hilus, and was still bleeding profusely. The gastro-splenic omentum was transfixed and ligated with heavy catgut, and the spleen removed. The presence of an accessory spleen was noted, about the size of a large marble, between the layers of the gastro-splenic omentum on the proximal side of the ligature. The semi-clotted and fluid blood was then rapidly removed by saline irrigation, and the wound completely closed, a small cigarette drain only being inserted into the peritoneal cavity at the upper angle. During the operation, which lasted fifteen minutes, the patient received 1,000 c.c. of saline infusion.

For 48 hours after the operation the patient was restless and the pulse varied between 120 and 135. On the third day it decreased to 80, and the subsequent convalescence was uneventful. At no time had there been either palpable glandular enlargement or bony tenderness. The leucocyte count varied from 32,400 on June 10, to 14,400 on July 15, the day of his discharge from the hospital. On November 23, 1907, six months after operation, the leucocytes numbered 9,200; polymorphonuclears

42; transitionals, 1; large mononuclears, 1; lymphocytes, 48; basophiles, 0; eosinophiles, 3.

Dr. Eliot said that in a third case of splenectomy upon which he operated about two years ago the method of clamping the pedicle and leaving the clamps *in situ* was followed with equally good results, and he had come to the conclusion that in those cases where there was need of haste, the application of the clamps was a more certain method of preventing hemorrhage than was the use of gauze packing.

Dr. Arpad G. Gerster said he was particularly interested in the peculiar comatose condition of the patient in the first case reported by Dr. Eliot, and it recalled to mind a somewhat similar experience of his own, of which he was still unable to offer a perfectly adequate explanation. The case he referred to was that of an old lady, very robust and well preserved both mentally and physically, who had borne a large number of children and who was then 67 years old. She was brought to the hospital three days after the beginning of an incarceration of an incomplete inguinal hernia. Upon opening the hernial swelling, a loop of small intestine was found to be gangrenous, as had been suspected, and a resection was done, removing fourteen inches of the gut. The two ends of the gut were joined together by means of a Murphy button. A saline infusion was introduced into the rectum, and the patient apparently bore the operation very well. The diet was restricted to liquids, nothing stronger than sugar water being given.

On the day following the operation the temperature rose to 101.5, and the pulse ranged from 100 to 110. On the second day she gradually lapsed into a state of absolute coma. There was nothing to indicate a cerebral, pulmonary or renal complication, but the woman could not be roused. She had received no anodynes. Her respirations were rather slow and shallow. The abdomen was perfectly soft; the urine was scanty and was passed involuntarily in small quantities. On the third or fourth day she began to pass her stools involuntarily into the bed, accompanied by the escape of copious gases.

Dr. Gerster said that in searching for a cause of this patient's coma, it finally occcurred to him that it was possibly due to inanition. She had been vomiting for three days prior to the operation and had received very little nourishment since. As she was

unable to swallow, a tube was introduced into the stomach and she was given a pint of peptonized milk. Shortly afterwards she began to show signs of animation, within three or four hours she opened her eyes, and from that time on her recovery was uninterrupted.

Dr. Willy Meyer, in discussing Dr. Eliot's plan of clamping the pedicle of the spleen and leaving the clamps *in situ*, said he thought he would under ordinary circumstances be better satisfied to ligate the pedicle unless it was very large as in Dr. Eliot's case, and there was danger of injuring the vessels in piercing it with the Deschamps needle. For about 18 months, the speaker said, he had followed the plan of using temporary clamps in nephrectomy as a routine treatment, and after having had six successful cases by that method, he ventured to employ it in the case of a young lady, the daughter of a colleague, who was tuberculous and very anæmic, and was operated on at her residence. In this instance, unfortunately, a hemorrhage occurred, when the clamps were removed on the fourth day after operation. A small rent in the afferent part of the renal artery was the cause. Although it was finally removed successfully, the patient died after 24 hours. Dr. Meyer said he would never resort to the clamp method again in kidney work, except being forced to do so.

The speaker said he had seen one case of this peculiar coma after gastroenterostomy; in which he did the operation with the short loop. The patient did well for about 36 hours and then lapsed into a condition of coma. She was treated with hypodermoclysis of saline solution three times a day for three days; on the fourth day she slowly recovered consciousness and made a good recovery. In that instance he attributed the condition to auto-intoxication from the intestinal tract, although it might perhaps have been due to inanition, as suggested by Dr. Gerster.

Dr. Robert H. M. Dawbarn, in discussing the subject of artificial feeding, apropos of Dr. Gerster's case, said that his experience had convinced him that the best food, and fortunately most simple and easily prepared, was milk (or cream) peptonized to extreme bitterness, plus sugar of milk. By this means a pint, or less as tolerated and retained, three times in twenty-four hours, and avoiding the rectal tube, which very soon became an irritant, however gently used—gravity taking its place—he had

nourished one patient (each injection following a prolonged hot oil massage everywhere) for six months. During this period nothing but water had entered the stomach. This person, who died of inoperable carcinoma of the stomach, and *not* from starvation, weighed after death nearly two pounds more than at the beginning of treatment. He called attention to the fact, moreover, that grape sugar was quite an irritant and that it was not wise to continue its use as a food for more than a very brief period. Only two-tenths of one per cent. of this sugar is to be found in the blood at any one time, the balance escaping through the kidneys as a foreign body, producing a temporary glycosuria; although it had never been known to cause nephritis or diabetes mellitus.

Dextrin, on the other hand, while an excellent article of food, was objectionable in some cases, recently sutured wounds of stomach or gut for instance, because it excited peristalsis and indeed does so more strikingly whether fed by stomach or bowel than any other dietary article. It is, on the other hand, our best reliance when there is stoppage of peristalsis; such as in the paralysis of bowel and stomach so often seen following operations for gangrenous appendicitis. Regarding starch, it was, though slowly, digested in both the small and large intestines; and at least one-half of the amount introduced was finally absorbed into the blood. Differing from dextrin, it did not excite peristalsis of the stomach or bowels.

Far too little attention, Dr. Dawbarn said, had been devoted to the subject of artificial alimentation, whether by bowel or skin, especially in this country. Animal oils were capable of rather greater absorption by the skin than vegetable oils. These facts he had ascertained a number of years ago after considerable experimentation.

Cod liver was one of the best of the animal oils, but was objectionable, when heated—as all oils must be to be absorbed freely—on account of its atrocious odor, then greatly exaggerated. Old fashioned goose grease, or hens' or turkeys' oil, were excellent, perhaps best of all, but quite expensive. A very satisfactory substitute was any one of the so-called "sweet-oils."

Dr. Eliot, in closing, said the comatose condition of his patient was thought at the time to be possibly due to the fact that the spleen had been removed, and acting on that supposition

she was fed for a time upon an infusion of fresh sheep spleens. Under that treatment the coma seemed to decrease somewhat.

## CARCINOMA OF THE MALE BREAST.

DR. WILLY MEYER in presenting a man, 48 years of age, said that this was the only case of carcinoma of the male breast that had come under his care since he had been doing the radical operation, devised by him, in 1894.

This patient when he was operated on four years ago had a characteristic scirrhus cancer of the left breast. The operation was done in the usual manner and the functional result was very good. In all of these operations, Dr. Meyer said, he never made an effort to spare the skin, and then attempt to close the entire wound by sutures, unless the edges could be readily brought together. He preferred to make a sweeping incision around the base of the breast and then cover the defect by grafting. There were no signs of a recurrence. The speaker said that in 39.5 per cent. of his cases of radical operation for cancer of the breast there had been freedom from recurrence for a period of between three and twelve and a half years; in 30 per cent. there had been freedom from recurrence for from five to twelve and a half years; 30 to 40 per cent. seemed to be permanently cured. Fifty per cent. died within the first three years after operation; the majority of those that safely passed the three year limit promised a permanent cure.

## STUDIES IN TECHNIQUE OF CANCER OF THE BREAST OPERATION.

DR. ROBERT H. M. DAWBARN read a paper with the above title, for which see page 374.

DR. GERSTER said that it would be ungracious not to thank Dr. Dawbarn for extracting from oblivion the proposition made by himself, systematically to attack cancer of the breast from the axillary end and thus to diminish the danger of dissemination and to save blood.

Dr. Gerster said further, he did not think the theoretical objections raised by the reader of the paper to the practice of making punctures of the breast for diagnostic purposes were well taken. A puncture, cautiously done, was less apt to cause

dissemination of the tumor infection than an incision, and the fact should always be borne in mind that a woman's breast should not be sacrificed without good reason.

The method of availing one's self of the immediate examination of frozen sections of a suspicious breast tumor was quite universally employed in the large hospitals in this city, and at the Mt. Sinai Hospital it was followed as a regular routine. Gummata of the breast were not infrequently mistaken for cancer, and the speaker said he never operated on a breast tumor without first giving the patient the benefit of a thorough course of treatment with large doses of potassium iodide for at least five or six days. By that time, if the growth was a gumma, especially if one of recent formation, it would begin to disappear, and the speaker said he recalled several instances where this simple precautionary measure had been the means of saving a breast.

Dr. Gerster said that under the very sound and rational teachings of Dr. Halsted and others, wonderful improvement had occurred during the past quarter century in the functional results after amputation of the breast, and that despite the extensive removal of the pectoral muscles. The main object of the radical operation was not to get a beautiful result, but to save life, and take chances with the wound afterwards. The better functional results to-day the speaker ascribed to the fact that suppuration was the exception rather than the rule and that the arm was not bandaged to the thorax as it was formerly. The apparatus for improving the functional condition of the arm demonstrated by Dr. Dawbarn was apparently sound in its principles, but it would probably prove irksome to the patient, and the same object could practically be accomplished by not bandaging the arm at all, simply passing a spica around the shoulder so as to hold snugly the dressings in the axilla.

The patient should be permitted to move the elbow, and the scar in the axilla should be allowed to heal with the arm in the posture of extension.

Dr. Eliot mentioned a case of supposed carcinoma of the breast which upon section proved to be one of abscess, but subsequently the microscope showed carcinomatous tissue in the abscess wall, and he raised the query whether in these cases of extensive abscess it would not be better to sacrifice the breast, excepting perhaps in young patients. He emphasized the impor-

tance of making a histological examination in these doubtful cases at the time of operation.

DR. DAWBARN, in closing, said that while the puncture of a suspicious breast tumor opened comparatively few lymphatics, these could not be sealed; whereas the multitude of lymphatics opened by an incision could be readily sealed within a few seconds by the use of Harrington's fluid for example. Not in the instance of Syme's advice, in search for a thick-walled deep collection of pus where we intend to cut to the centre of the tumor at a stroke, but in almost all other instances where we wish to remove for microscopic diagnosis a small piece of a tumor, Skene's hawkbill scissors is the best, because quite the quickest, tool to use.

It was not probable in a case of the kind referred to by Syme that mere drainage would suffice. Doubtless excision of the dense walled abscess would be best. Where by freezing microtome (if the abscess wall looks suspicious) malignancy is established, the radical operation for cancer should of course be done; but if non-malignant, he could not agree with Dr. Eliot in advocating the mutilating operation.

As to the opinion expressed by Dr. Gerster that the new position of the upper extremity would prove irksome (obtained by aid of the familiar triangular splint shown by the speaker for hastening the return of certain important movements otherwise more slowly regained):—the speaker replied that the splint seemed to him as simple as possible. Some of the patients, as yet few in number, upon whom this had been used, did not complain of it at all. Its use is never maintained for more than a week at most. Those who did find it tiresome (as any immobilization whatsoever quickly becomes to certain people) were relieved and made comfortable by simply releasing the fore-arm. Ochsner of Chicago accomplished the same thing with the use of a sling and tackle by which the arm was elevated, traction from the comfortably padded hand being employed directly upward. Dr. Gerster's choice of arm-posture (abduction to a right-angle with the body) is obviously a very great gain over the custom with most operators, unfortunately still the rule, of bandaging this member close to the side, with the regular result of months of greater or less misery before the scar is stretched to permit of the patient doing her hair. This abduction, however, renders impossible its employment of the speaker's muscle-grafting plan.

*Stated Meeting, December* 11, 1907.

The President, Dr. Joseph A. Blake, in the Chair.

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## NEPHRECTOMY FOR TUBERCULOSIS.

Dr. Alexander B. Johnson presented four patients who had been subjected to nephrectomy on account of tuberculosis of kidney.

The speaker said he showed these cases because they illustrated fairly well certain points. One of these was that it was possible to obtain a satisfactory result in tuberculosis of the kidney even though the process was far advanced and associated with an infection of the tissues around the kidney, whether of tubercular or septic origin. The second point was that nephrectomy was the only operation that promised a favorable result. In three of his cases there was a large tubercular peri-renal abscess, and in one instance it was impossible or impracticable to remove the kidney as a primary operation, because the condition of the patient did not seem to warrant it. In two of the cases the kidney was removed at the same time that the peri-renal abscess was opened, and although the convalescence in one of those cases was slow, it was satisfactory. In the fourth case the condition was not tubercular, but pyogenic, and probably due to multiple renal calculi. That case was a good illustration of the fact that a cure could not have been effected excepting by nephrectomy, a nephrotomy having already been done and failed.

The first case was a man, 44 years of age, who entered the hospital in August, 1906. There was no history of venereal disease. Four years before he had commenced to suffer from painful and frequent urination. His urine had become purulent. He had not passed blood. He had not suffered from pain at that time referred to the region of the kidney. He had slowly but steadily lost flesh and strength. During the four weeks preceding he had had continuous dull pain in the left lumbar region. His urine had been at times very cloudy and during other shorter intervals quite clear. Two weeks before he had first noticed a swelling in the left flank which had become red and tender. He had lost much flesh and become very weak. Upon physical examination he was seen to be emaciated and profoundly anemic.

There was a large fluctuating swelling in the left flank, moderately tender, extending well down below the umbilicus and from the outer border of the quadratus lumborum muscle nearly to the median line in front. The patient had a daily evening rise of temperature and looked very ill indeed. His urine contained much pus, but no tubercle bacilli were found. The abscess was incised and was found to communicate with the kidney. Owing to the very feeble condition of the patient and the very dense adhesions surrounding the kidney it was thought best not to attempt to remove the kidney at that time. A portion of the kidney was removed merely of sufficient size for pathological examination. It proved to be the seat of tuberculosis. The patient's general condition improved greatly and two months later he was able to leave the hospital in fair general health but with a tubercuolous sinus leading to the kidney. He refused to have his kidney removed at this time. Six months later he re-entered the hospital with another abscess and in bad general condition. The abscess was incised, he again improved, but returned six weeks later to have his kidney taken out. This was done by an incision below and parallel to the ribs. The removal of the kidney was difficult on account of the dense adhesions. After this operation he made a good recovery. His wound healed. His general health improved and his urine ceased to contain pus. The kidney showed advanced tuberculous lesions. His general health at the present time is good, six months after the last operation.

The second case was a woman, 32 years of age, who was admitted to the hospital September 9, 1907. One year before, she had commenced to have continuous pain in the right lumbar region. Her urine had become purulent. From time to time she had had attacks of pain referred to the right loin. No tubercle bacilli had been found in her urine. She had lost much flesh and strength and had become markedly anemic. The cystoscopic examination of the bladder showed the bladder wall congested. The orifice of the right ureter was red and swollen. Purulent urine could be seen escaping from it. Catheters could not be introduced. The left ureter opening appeared normal. The patient's general condition was poor. She was feeble and anemic and had a daily evening rise of temperature with occasional sweating at night. The right loin was occupied by a large,

elongated, tender tumor extending downward as far as the navel and upward beneath the ribs. The tumor was fixed. The colon lay to its outside but crossed it in front. The right kidney was removed by an incision below and parallel to the ribs. The tumor was found to consist in its lower half of a large pyonephrotic kidney showing the lesions of an ancient tuberculosis upon which had been engrafted a secondary pyogenic infection. The kidney measured 12 x 7 x 8 cm. The upper half of the tumor consisted of a large abscess lying between the diaphragm and the kidney. The kidney was removed and the abscess evacuated; its walls were scrubbed with masses of sterile gauze. The patient made a very good convalescence and the very large wound healed for the most part per primam. She rapidly gained flesh and strength. Her urine ceased to be purulent. At the present time, two and a half months after the operation, her health is excellent.

The third case was one of pyogenic infection of the kidney. He was a man 46 years of age. An Italian. Admitted on July 6, 1906. Two weeks before he had commenced to have pain in the right loin, accompanied by chills and fever with diarrhœa. His urine had become cloudy and he had increased frequency of urination. Upon admission to the hospital he was anemic, emaciated and distinctly septic. There was marked pain and tenderness over the right kidney and muscular rigidity of the muscles of the right half of abdominal wall. His urine contained a large amount of pus. On the day following his admission he was operated upon by another member of the attending staff of the hospital, who exposed the right kidney and incised and drained an abscess cavity in the lower pole. The patient remained septic after this operation; his urine continued purulent. Two weeks later the kidney was removed by Doctor Johnson through an incision below and parallel to the border of the ribs. The kidney was the size of a large grape fruit. The outer surface was rough. The capsule was densely adherent. On section, the pelvis and calices were found greatly distended with thick grayish pus containing many pyogenic cocci and a large number of minute uric acid calculi. The patient made a rapid convalescence and has since remained in good health.

The fourth patient was a case of tuberculosis of the right kidney, with a large peri-renal tubercular abscess. The patient was a married man, 34 years old, whose previous history was

negative. He stated that during the past few years he had not been as robust as formerly. He had no cough. For more than a year he had moderate soreness in the right lumbar region. During the past nine months he had been steadily losing flesh and strength. He had had night sweats. He had never had any sharp pain in the region of the kidney, ureter, testis or glans penis, nor had he ever suffered from frequent or painful urination. He had never passed blood, but had noticed for several months that his urine was cloudy. The sputum and stools were negative for tubercle bacilli. The urine contained a moderate amount of pus and a few blood cells. Tubercle bacilli were found in the urine on one occasion after many trials; otherwise the urine was normal in quantity, specific gravity and content of urea. The patient was emaciated and feeble. He had attacks of diarrhœa, with an evening rise of temperature followed by a cold sweat almost every night.

Upon inspection, there was a distinct fullness of the right flank, extending downward in front as far as the crest of the ilium. There was tenderness and rigidity of the abdominal wall on that side, extending nearly to the median line, with a diffused sense of resistance, but no tumor could be definitely outlined on account of the rigid contraction of the muscles.

A diagnosis of tuberculosis of the right kidney was made, with tubercular peri-renal abscess, and probably a nearly impervious ureter. An incision was made below and parallel to the ribs, opening into a peri-renal tuberculous abscess which extended downward into the right iliac fossa and required a subsequent oblique incision nearly at right angles to the first to drain it. The kidney was found surrounded by a dense, thickened, fatty capsule, firmly adherent to the surrounding structures. It was removed with some difficulty, together with as much of the tubercular ureter as could be reached. The tuberculous abscess cavity, which appeared to extend nearly to the bottom of the pelvis, was curetted, and the large wound was partially closed, packed with gauze, and drained. There was marked shock, from which the patient slowly recovered after stimulation and infusion.

An examination of the extirpated kidney showed two large cavities near the surface, each about three and a half centimeters in diameter, one having a smooth wall, like a retention cyst, the other a roughened and partly caseous wall. Miliary and slightly

larger tubercles were numerous throughout the cortical portion of the organ. The lumen of the pelvis and ureter were enlarged, their walls were thickened and they contained many miliary tubercles. There was some ulceration of the pelvis, and a chronic interstitial inflammation of the kidney. In many respects the lesion appeared to be a comparatively recent and active one.

The patient survived the operation, but the very large wound closed slowly. After several months a second operation was done to afford better drainage for the large cavity, which extended into the pelvis. It was thought that the stump of the ureter was the cause of the tardy healing, but careful search failed to disclose any sinus which seemed to lead to the base of the bladder. The whole wall of the rather large wound was curetted, and after this the wound slowly healed down to a sinus which remained open many months, but finally healed after a sojourn in the country. In the meantime the patient's general health had improved. Four years after the operation he was still in perfect health, leading an active life and weighing nearly 200 pounds. His urine remained clear and normal and he had no bladder nor other urinary symptoms. His condition at present (five years after the operation) was one of perfect health.

Dr. Howard Lilienthal said that while he was willing to admit that a calculous pyelonephritis was rarely cured by a nephrotomy, he had seen such a favorable result in several instances. He recalled one case which had been operated on a number of years ago by Israel for a pyelonephritis of the right kidney. After long-continued suppuration of the opposite kidney Dr. Lilienthal removed a calculus therefrom and after this the ureter became plugged for a time and the urine became absolutely normal, coming entirely from the kidney first operated on. The question was largely one of drainage. If the ureter was pervious and permitted of proper drainage, the speaker said he saw no reason why such a kidney should not recover after a nephrotomy. Otherwise, of course, it should be removed. Because pyelonephritis due to stone was seldom cured by nephrotomy was no reason for denying the operation a good chance. In fact, under certain conditions, it should be the first procedure even though nephrectomy became necessary later. The mere fact that a kidney was tuberculous did not constitute a sufficient reason for nephrectomy; that operation depended more on the extent of the

tuberculous destruction, and many cases of tuberculosis of the kidney recovered without operation. Of course, in dealing with extensive abscess formation, and when the patient was going down hill, the kidney should be removed if its fellow were healthy.

In discussing the question of the removal of the ureter in these cases, Dr. Lilienthal said the method he had practiced was to first complete the nephrectomy and then, if necessary, at a subsequent time, make an extra-peritoneal lateral incision for exposure of the ureter. By this method the upper portion of the ureter could be pulled away and the lower end was well exposed, and could be cut off as close to the bladder as was necessary.

Dr. Samuel Alexander, in discussing the best incision or approach to the kidney, said he believed the incisions usually employed were unnecessarily extensive. Personally, he used a crescentic incision beginning about an inch or two in front of the angle formed by the twelfth rib and the erector spinæ muscle; the convexity of the incision was directed backward and the lower arm of the crescent ended at a point about two inches below the crest of the ilium, which gave an excellent exposure of the kidney and access to the upper part of the ureter. The speaker said that in tuberculous cases the amount of the ureter that was necessary to remove was very small. In cases that were likely to recover after operation, the infection, if primarily renal, was limited to the upper segment of the ureter. In this connection, the speaker called attention to the fact that the upper and lower segments of the ureter were the only portions containing lymphoid tissue, and for that reason were the sections most likely to become infected.

As to the choice of operation in tuberculosis of the kidney, Dr. Alexander said that in cases where the diagnosis was positive he thought there was no question that a nephrectomy was indicated. In such cases, the removal of the focus of infection was necessary for a cure. In pyelonephrosis of colon bacillus origin where there were no sacculations a nephrotomy with drainage of the pelvis of the kidney was all that was necessary.

Dr. F. Tilden Brown said that surgeons had now fairly well agreed that if any operation was to be done for tuberculosis of the kidney, that operation was nephrectomy, whenever possible. The position, size and shapes of the incision was to be determined

by the conditions in each individual case. He was inclined to believe, however, that in the treatment of these cases we were on the verge of something else besides operation, namely, the use of tuberculin. He had had some experience both impersonal and direct with this, which has led him to be rather optimistic over its use in the treatment of not too extensive chronic tubercular disease of the genito-urinary tract.

Dr. Brown approved of Dr. Lilienthal's method of gaining access to the kidney and lower ureter through a separated retroperitoneal lumbar and iliac incision. But was inclined to criticize this operator's surgical conservatism in cases of tuberculous kidney, especially in view of the radical measures he advocated for the corresponding ureter. The speaker expressed his belief that the ureter, when once relieved of the tuberculous kidney, would often take care of itself. At the time of division of the ureter, however, very careful asepsis should be maintained, against any soiling of the surrounding tissues. Too much care with underlying gauze protection could not be exercised in dealing with the ureter wherever severed; it required just as careful attention as did the appendix and much the same technic. After ligation of the vessels of the pedicle of the kidney and its attached part of the ureter, the speaker thought it an effective yet conservative measure to use a long-handled, very small, sharp curette to bring out the mucosa of the ureter, or else inject a small quantity of a strong antiseptic or escharotic.

In the vast majority of cases of tuberculosis of the kidney, Dr. Brown said, the condition should be dealt with in a radical fashion. The only case of that kind regarding which he had any regrets was one which he had been at the time strongly inclined to commend for seeking conservative treatment at the hands of a colleague. That patient had since died from an extension of his disease, while other more desperate cases that had been dealt with radically were still alive and well. In fact the speaker was unable to recall an instance of death from any cause yet among his fairly numerous series of cases operated on for unilateral renal tuberculosis.

Dr. Willy Meyer said that in cases where we could prove that one kidney was tuberculous while the other was healthy, it was our duty to remove this primary focus of the disease, in spite of the fact that conservative treatment might at times

be followed by favorable results, inasmuch as a definite prognosis in the given case was a clinical impossibility.

In dealing with the ureter in these cases it usually sufficed to remove as much as could be conveniently reached from the primary incision, followed by an injection into the stump of the ureter of a small amount of pure carbolic acid followed by alcohol. The cut end of the ureter should always be ligated if the cystoscope showed ulcerations about the ureteral orifice. The speaker recalled one case where after nephrectomy the urine from the opposite kidney found its way through the untied cut end of the ureter that had been left behind, due to ulcerations around the vesical ureteral mouth, which had destroyed the physiological muscular sphincter.

Dr. Johnson, in closing, said he had removed many kidneys through the anterior incision such as he had described in connection with his cases, and he had seen many patients who had been operated on by others by the same method, and he had not observed a single case in which a hernia followed, although he had heard of one or two such cases. One of the advantages of this particular incision was that it exposed the front of the kidney, and after tying the vessels of the pedicle, the enucleation became a very simple matter. The speaker said he did not know of any other incision, excepting a very long one extending downward and forward, which possessed this particular advantage. He agreed with the other speakers that the stump of a tuberculous ureter rarely gave rise to trouble if one removed as much as could be conveniently reached as far as the brim of the true pelvis. Nephrectomy was certainly the operation that was indicated in cases where the tubercular lesion was limited to one kidney, and it was also the best procedure in pyelonephrosis. He could not recall a single instance of this kind in which the patient's condition was notably improved by a nephrotomy. Another point to bear in mind was that when once the kidney had been incised for pyelonephrosis, a subsequent operation for its removal was rendered much more difficult and dangerous. That such a necessity frequently arose the speaker said he could testify to from his own experience.

## SARCOMA TREATED BY MIXED TOXINS.

Dr. William B. Coley presented the following three cases:

Case I.—*Round-celled Sarcoma of the Back, Three Times*

*Recurrent; Final Disappearance Under the Mixed Toxins of Erysipelas and Bacillus Prodigiosus. Well at Present, Two and a half Years Later.*

W. J., male, aged 14 years. Family history good. In the latter part of August, 1901, the patient fell from a stoop, striking on his back. Two or three weeks later the mother noticed a swelling in the midscapular region, a little to the left of the median line. This swelling increased very rapidly. It was soft and fluctuating from its beginning. The patient was referred to Dr. Coley in December, 1901, by Dr. Polhemus, of Nyack, New York. Physical examination at that time showed a cystic swelling the size of an orange in the left scapular region. The skin was normal, the tumor fluctuating, situated apparently just beneath the skin and superficial fascia. On January 12, 1902, an incision was made under ether and several ounces of dark blood were evacuated. There was no evidence of any solid tumor at this time. The wound closed without drainage and healed by primary union. About three weeks later a tumor began to develop at the original site; this was also cystic in character, increased rapidly in size until May, when it had become one-third larger than at the first operation. Dr. Coley then operated again under ether anesthesia, finding at this time, in addition to fluid blood and clots, such a thickening of the walls of the cyst as to make him suspicious of sarcoma. A portion of this thickened tissue was removed and examined by Dr. H. T. Brooks, Professor of Pathology at the Post-Graduate Hospital, who pronounced it small round-celled sarcoma of high vascularity. Two weeks after the operation and before the wound had entirely healed, the X-ray treatment was begun and continued three times a week. The treatment was kept up the entire summer and fall of 1902. In December, 1902, there was well-marked evidence of local recurrence in and about the cicatrix. The tumor continued to increase in size in spite of X-ray treatment. On January 26, 1903, Dr. Coley operated a third time under ether anesthesia and removed the recurrent tumor together with the old cicatrix. The wound healed by primary union. Shortly after he left the hospital, the X-ray treatments were resumed, and continued once or twice a week during all of 1903 and the first half of 1904. In June, 1904, there began to appear signs of another recurrence in the old cicatrix, and this time, in addition to the X-ray, the local injec-

tions of the mixed toxins of erysipelas and bacillus prodigiosus were begun. The injections were continued until June, 1905, with the result that the recurrent tumor disappeared, and the patient has remained perfectly well up to the present time, six years after the first operation and three and a half years since the toxin treatment was begun.

CASE II.—*Interscapular Thoracic Amputation for Sarcoma of the Humerus; Recurrence; Disappearance Under the Mixed Toxins of Erysipelas and Bacillus Prodigiosus.*

G. M. W., female, aged 15 years. The patient received an injury to the arm ten years ago, by running against a banister. She first noticed pain in the upper portion of the right arm near the shoulder in December, 1906. Two to three weeks later a swelling appeared, which increased in size rapidly. In February, 1907, she consulted a physician, who treated her for rheumatism.

The patient was referred to Dr. Coley by Dr. V. P. Gibney in June, 1907. Physical examination at this time showed a pear-shaped enlargement of the right humerus, involving the upper two-thirds. The circumference was three inches larger than the other arm. The mixed toxins of erysipelas and bacillus prodigiosus were tried for two weeks with the hope of saving the arm. At first there was a slight decrease in size, but later the tumor increased in size and amputation was advised. After two weeks of deliberation the family finally consented to an amputation.

On July 11, 1907, with the assistance of Dr. W. A. Downes, at the General Memorial Hospital, Dr. Coley performed an interscapulo-thoracic amputation. The clavicle was sawn through at about the middle with a Gigli wire saw; the subclavian vein and artery were easily found and ligated. The nerves of the brachial plexus were then injected with a one-tenth of one per cent. solution of cocaine; the operation was then easily completed with almost no loss of blood. At the point of division the lumen of both vein and artery was found nearly blocked by sarcomatous thrombi; the glands under the arm were also invaded. There was practically no shock following the operation and the patient made an uninterrupted recovery. It was Dr. Coley's intention to have the toxins started as soon as she was over the operation, but as he was absent from town, this was not done and she returned home. At his examination early in October,

he found evidence of local recurrence in the pectoral region, just above the breast and also in the upper portion of the wound in the clavicular region. She was re-admitted to the General Memorial Hospital on the 10th of October, and for the last six weeks has had the injections with the mixed toxins on an average of three to four times a week. She has gained four pounds while under the treatment, and her present general condition seems perfect. All evidences of local recurrence have disappeared.

CASE III.—*Inoperable Spindle-celled Sarcoma of the Abdominal Wall and Pelvis Treated with the Mixed Toxins of Erysipelas and Bacillus Prodigiosus from December, 1892, to June, 1893; Entire Disappearance; Patient Well at Present, Fifteen Years Later.*

J. F., aged 16 years (at the time the treatment was begun), suffering from a large tumor involving the lower portion of the abdominal wall, attached to the bladder and pelvis. The patient, who was confined to his bed and had lost considerable weight, was referred by Dr. L. Bolton Bangs, in December, 1892. as a totally hopeless, inoperable case. A portion of the tumor was removed for microscopical examination, and was pronounced spindle-celled sarcoma by Dr. H. T. Brooks, pathologist at the Post-Graduate Hospital. He received injections with the mixed toxins of erysipelas and bacillus prodigiosus from December, 1892, to June, 1893. At the end of this time the tumor had entirely disappeared. The patient received no further treatment and has remained perfectly well with no signs of recurrence up to the present time.

This case, in addition to representing the oldest cure (well nearly fifteen years) obtained by the toxine injections, is of peculiar interest from another standpoint, *i.e.,* the theory of possible syphilitic origin. The age of this patient was sixteen years at the time the treatment was begun; there was absolutely no history nor evidence of congenital syphilis. Six to seven years after the tumor had disappeared in this case and the boy had grown up into manhood, he contracted a typical primary lesion of syphilis, which ran the usual course, practically proving that his original tumor of the abdominal wall and pelvis which had disappeared six years before under the toxin treatment, was really spindle-celled sarcoma, as shown by the microscope, and not a syphilitic growth.

## VOLKMANN'S ISCHAEMIC PARALYSIS OF FOREARM.

DR. HOWARD LILIENTHAL presented a boy, 4½ years old, who was admitted to the Mount Sinai Hospital on April 20, 1907. His previous history was unimportant. About five and a half months ago the patient fell from a chair about three feet high; he struck on his right hand, and was supposed to have sustained a fracture about the elbow joint. He spent ten days in the Brooklyn Hospital, where an adhesive strap dressing was applied, with the forearm flexed upon the arm at a very acute angle, and over this an immobilizing bandage was applied. For four days after the straps were removed the fingers were held straight; they then began to flex, and the flexion had slowly progressed. Coincident with this, flexion of the wrist had developed, and the patient had complained of slight pain in the fingers. The condition had been treated with rubbing and electricity. There had been no athetoid movements; no convulsions.

Examination of the affected wrist showed that it was in a position of permanent adduction. Abduction, both active and passive, was impossible on account of muscular interference. The forearm was in a position of almost complete pronation. Passively, complete pronation could be produced. Supination was impossible. There was complete reaction of degeneration in all the muscles of the hand, excepting those of the thumb; the latter reacted normally. Nerve reactions, as well as all sensations, were normal. The hand was cool up to an inch below the wrist; above that point it was warm. Neither the radial nor ulnar pulse could be felt nor any other pulsating vessel in the hand or forearm.

The muscles of the forearm had a dense, hard, board-like feel, suggestive of a fibrous change. All active movements were very weak. The external condyle of the humerus was twice as large as that on the corresponding side, and occasional crepitus was elicited over the external condyle on flexing or extending the elbow. There was a superficial recent scar over the styloid process of the ulna.

On April 29 a well-padded dorsal splint was applied for four hours. When it was removed, there was a skin necrosis on the dorsum of the wrist. On May 24 an inch and a half incision was made over the most superficial portion of the radius and over the ulna. About an inch of each of these bones was then removed

sub-periosteally with the cranial rongeur, the radius was hollowed out and an aluminum splint an inch and a half long and with an outside diameter of one-quarter inch was implanted into it. The ends of the divided ulna then came accurately together. The skin was sutured with silk, and a plaster-of-Paris dressing applied with the wrist extended. A specimen removed from one of the involved muscles showed an interstitial myositis, with atrophy.

On September 14, 1907, the movements of the fingers and hands were slightly improved.

Dr. Lilienthal said he had seen two other cases of ischæmic paralysis of the forearm following Colles' fracture.

Dr. Alfred S. Taylor said that in a case which came under his observation about four months ago there was a history of an old fracture of the humerus, just above the elbow. There was marked deformity, and a cicatricial mass occupied the place of the flexor muscles in the forearm. The ulnar and median nerves were also involved in this cicatricial mass. Dr. Taylor resected one inch of each bone of the forearm. Slight improvement followed the operation. Hyperæmia from obstruction of the blood current by the Bier method was applied for two hours each day, and helped to soften the cicatricial mass somewhat.

In all these cases, Dr. Taylor said, the condition of the nerves should be examined. In the case he had reported both the median and ulnar nerve were found to be compressed. Now after six months returning nerve power is evident.

Dr. Charles N. Dowd said that this was the third case he had seen of fracture about the elbow joint followed by this peculiar form of paralysis in which the bandage pressure had not been sufficient to injure the skin, and he had seen other cases in whom skin ulceration and direct muscle injury were present. It was certainly a condition that surgeons had reason to fear. The speaker said he believed that some peculiar susceptibility of the patient to injury from moderate pressure might well be an influence, that it was still a question whether injury of the nerve had anything to do with it. In one of his cases he found a spicule of bone pressing on the median nerve, while in another case the nerve was displaced.

The deformity seemed to be due to a hardening and atrophy of the muscle itself, as described by Volkmann in his original

description of the condition. He advised Dr. Lilienthal to leave his case alone, as the flexor muscles had very little action. In the two cases that had been under his observation he did not resort to any bone operation, and the condition improved somewhat under massage.

Dr. Joseph A. Blake mentioned one case where after a fracture above the elbow the tissues of the arm seemed to undergo this same form of degeneration, and the nerves, which were dissected out, were apparently in the same condition. The patient improved somewhat under massage, but was lost sight of.

Dr. Lilienthal, in closing, said he believed that tendon lengthening and the freeing of the muscles had been attempted in these cases, but without good results. The speaker said he did not look upon tendon lengthening as a favorable operation in a case where so many tendons were involved.

## THORACOPLASTY FOR SINUS AFTER EMPYEMA FOLLOWING SUBPHRENIC ABSCESS.

Dr. Charles A. Elsberg presented a young man of 22, who was admitted to the Mount Sinai Hospital on June 23, 1907. The patient gave a nine weeks' history of fever, cough, and rapid loss of flesh and strength. There was a large mass in the right lumbar region, and signs of fluid in the right pleural cavity. A subphrenic abscess bulging into the perinephritic space was opened through an incision below the twelfth rib, the empyema drained by the resection of the ninth rib. The pus from both regions contained the streptococcus in pure culture. The patient's condition grew steadily worse, high fever and rapid pulse persisting. He suddenly developed a large inflammatory mass in the back, which was opened widely and drained when the patient was almost moribund. No pus was found, but the fluid from the wound contained streptococci in large numbers. Within twelve hours the patient's condition was much improved, and thereafter he gained flesh and strength rapidly. All of the wounds healed well with the exception of the empyema, where a long sinus persisted.

On September 20th a thoracoplasty, according to Schede, was done, six ribs being removed. The patient made an excellent recovery from the operation, and was discharged from the hospital with a healed wound on November 5th.

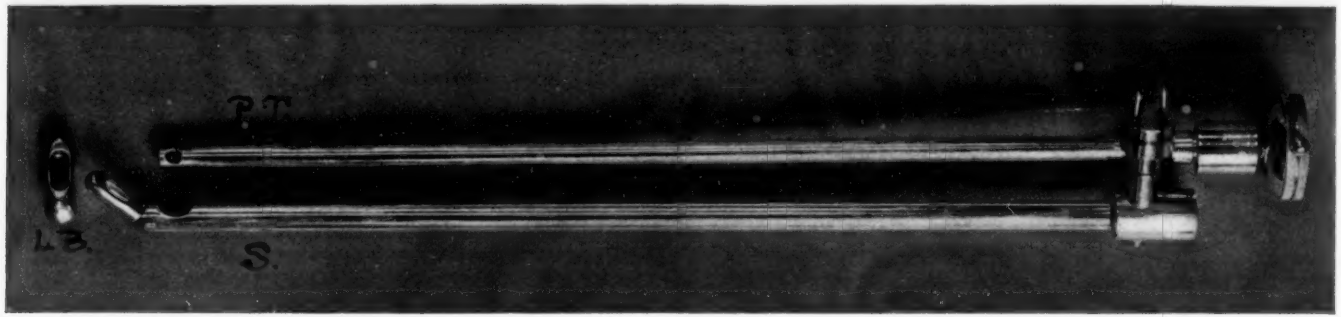
## UNILATERAL RENAL HAEMATURIA DUE TO PYELITIS CYSTICA.

DR. IRVING S. HAYNES read a paper with the above title, for which see page 417.

DR. F. TILDEN BROWN said the case reported by Dr. Haynes was certainly a novel one of hæmaturia. The clinical course of the case as well as the pathological findings suggested a hæmorrhagic condition of the pelvis of the kidney, but we should bear in mind that not a few of these rare cases of reported pyelitis cystica were associated with a corresponding condition in the ureter, where a considerable amount of the bleeding might have its origin. If the hæmorrhage in such a case was grave enough to threaten life, Dr. Brown said he would concur with the reader of the paper that a nephrectomy was the proper procedure, but if, on the other hand, the hæmaturia was not grave, it would perhaps be advisable to do everything to save the kidney, for the reason that in 50 per cent. of these cases the condition was shown to be bilateral, even when ureteral catheterization failed to afford evidence of the fact, which need not excite surprise since the bleeding on either or both sides may temporarily cease.

Dr. Brown said that from the fact that a perineal operation for access to the bladder was done by the reader of this paper as a preliminary step, some of the patient's symptoms were probably referable to this viscus. The speaker desired to be corrected in regard to his understanding or misunderstanding of the reader's definition of pyelitis cystica as being a condition of the mucosa of the renal pelvis similar to that of the bladder during a cystitis. The speaker supposed that the adjective cystica had reference to a not necessarily acute inflammatory process but rather the reverse, where by some unknown reason the epithelial lining was raised by serum to form numerous small discrete vesicles, blebs or cysts. The speaker recalled twenty years ago a case of his own of hæmorrhagic pyelitis in a pregnant young woman from whom, after many days of persistent and excessive bleeding, Dr. McBurney found it necessary to remove the kidney to preserve life.

DR. HAYNES, in closing, said the picture he intended to convey by the term "pyelitis cystica" was one that represented the same changes that occurred in chronic cystitis of the bladder. The bladder showed evidences of chronic cystitis, and for that




F. Tilden Brown's shorter lamp-beak; applicable to any form of indirect vision (prismatic) cystoscope which secures a closer approximation of lamp and lens than heretofore; hence better visual properties. (L.B.) Detail of lamp-beak. (S.) Sheath with short lamp-beak attached. (P.T.) Prism telescope.

reason he had drained it. The opposite kidney, so far as could be ascertained, was normal. The speaker said he appreciated the fact that the removal of a kidney of this kind was a serious problem; still, this patient had had the trouble for a considerable time, and was anxious to be relieved and nothing short of a nephrectomy was positive in its results.

## AN IMPROVED CONSTRUCTIONAL DETAIL IN THE CYSTOSCOPE.

Dr. F. Tilden Brown showed a cystoscope, in this instance fitted to the W. K. Otis examining cystoscope, characterized by a new and shorter elbow for effecting the junction of beak and shaft, a feature which he believes will at once prove of considerable advantage and beneficial adaptation to all cystoscopes, especially those of the prismatic or indirect vision type (Fig. 1).

This new technical detail in the construction of cystoscopes and one which Dr. Brown wishes to place on record will afford the following advantages: First, a closer approximation of lamp and lens, consequently a better illumination of the field. Secondly, a shorter beak, and for that reason one more easily passed to the bladder. Thirdly, a moderately curved heel in place of an acutely angled one, which also facilitates introduction.

# TRANSACTIONS

OF THE

# PHILADELPHIA ACADEMY OF SURGERY.

*Stated Meeting held December 2, 1907.*

The President, JOHN B. ROBERTS, M.D., in the Chair.

## MELANOTIC SARCOMA OF THE SHOULDER.

DR. JOHN H. GIBBON exhibited a case of melanotic sarcoma of the shoulder and showed photographs of the patient before operation. The patient was a child of eight years of age, upon whom Dr. Gibbon operated last March. She had a large melanotic growth involving the skin over the shoulder and back. There was also a metastasis to the axillary glands. Numerous melanotic spots were observed in the skin all over the body and face. The growth was removed, together with the glands. Several skin grafting operations were subsequently performed. The wound is now all healed excepting an area about the size of a dime. The child has put on weight, and looks and seems perfectly well. There has been an increase, however, in the number of black spots in the skin. The clinical diagnosis was melanotic sarcoma and this was confirmed with the microscope.

## FALSE ANEURISM OF THE FEMORAL ARTERY.

DR. GIBBON also exhibited a man with a large swelling in the lower third of the thigh; this man had been shot through the thigh twenty years previous. From the history it seemed that he had developed some years later an anuerysm in the neighborhood of Hunter's canal. Last February the swelling became much larger and has recently gradually increased, until it reached its present proportions. A bruit can be heard over the inner aspect of the tumor, but nothing can be heard over the outer portion of it. It extends across the posterior and two lateral aspects of the lower portion of the thigh. The veins over it

are very much dilated. There was a question whether this was a pulsating sarcoma, or whether it was a ruptured aneurysm. Dr. Gibbon was inclined to think it was the latter condition.

(The patient has since been operated upon and a large false aneurysm due to gunshot injury of the vessel was found. A Matas operation was done and several portions of the bullet and spicules of bone were found embedded in the vessel wall. The patient is making a good recovery.)

DR. J. CHALMERS DA COSTA stated that on examining this patient he had thought the condition was an aneurism, the result of injury in Hunters' canal, and that its situation had made the development slow. The fact which particularly attracted his attention was the sudden increase in size of the swelling, which the patient stated had occurred in a single night. Since then the swelling has progressed slowly

DR. OSCAR H. ALLIS said that he had had a case somewhat similar to the one exhibited, at the Presbyterian Hospital, and that the bruit was so distinct in the popliteal space that everyone who examined the case regarded it as one of aneurism, but it was shown to Dr. Samuel W. Gross and he immediately said it was not an aneurism, and it was later proved that it was sarcoma.

## ENCHONDROMA OF CLAVICLE.

DR. GIBBON also exhibited a specimen of enchondroma of the clavicle. This growth, which was larger than two fists, was attached along the outer one-third of the posterior border. The tumor had grown down underneath the clavicle and underneath the scapula, it also filled the supraspinous fossa and covered the spine of the scapula and came forward over the clavicle. Because of its slow growth it was supposed to be an osteoma or enchondroma, but it was feared that a sarcomatous change might have taken place. The patient was an adult aged 49. The clavicle and scapula constricted the tumor in its centre, giving it the appearance of an hourglass and rendering its removal very difficult.

## GUNSHOT WOUND OF BRAIN.

DR. J. CHALMERS DA COSTA reported a case of gunshot wound of the brain. The patient was 50 years of age. Six months before Dr. Da Costa first saw him he had attempted suicide by shooting himself in the head. The weapon was a

revolver the calibre of which was No. 22. He shot himself back of the right ear and the bullet did not emerge. He is said to have been unconscious for hours after the infliction of the injury. He gradually recovered from the coma but was found to have almost complete amnesia. He remembered his name and had some hazy knowledge of his life before he shot himself, but had no knowledge whatever of recent events and no memory of the suicidal attempt. Shortly after the accident he developed epileptiform attacks in each of which there was complete unconsciousness for a brief period and irregular generalized muscular spasm. The epileptiform attacks were occasional and irregular. On entering the hospital it was found that there were no distinct sensory phenomena, that the eye grounds were normal, and that the epileptiform seizures did not have a local beginning. Amnesia was complete as to all events subsequent to the injury and to most events before it. The registration element of memory was completely destroyed and the reproductive element was sadly impaired. Dr. Manges, by the X-rays, located the bullet beneath the parietal eminence of the left side. The patient was showed to the clinic as a case in which a bullet had crossed the brain and lodged beneath the cortex of the site opposite to the entry. A diagnosis of subcortical left-sided lesion was made. That very afternoon he developed status epilepticus of great violence. His life was thought to be in imminent peril and he was trephined over the supposed point of low gunshot. The dura was normal and when it was opened the cortex appeared normal. The cortex was incised and at a depth of one-fourth of an inch a cavity was entered. The cavity contained some partly clotted blood and some fragments of brain substance adherent to fibrous tissue and to the the bullet. The bullet was removed. It was partly flattened and had a bit of fibrous tissue and some brain substance firmly adherent to it. It seemed that the projectile had been encysted but had been detached from its encompassing wall. A piece of gauze was inserted, the dura was sutured and the wound was closed.

For some days he was very delirious but he gradually recovered and now is vastly better. At this period (2 months after operation) his memory has notably improved and he remembers well all events antecedent to his suicidal attempt. Registration is again taking place and he remembers things from day to day,

but has no memory whatever of the time between the shooting and the time at which he became fairly normal after the operation. Dr. Da Costa had hoped to have had him here at the meeting but his family had failed to bring him. The bullet was found in the exact position and at the exact depth indicated by Dr. Manges.

## GUNSHOT WOUND OF THE SPINAL CORD.

DR. DA COSTA also reported a case of gunshot wound of the dural spine. This man had been shot by accident some weeks before. He had had a laminectomy performed upon him but the bullet was not found. On admission to the hospital it was found that he had the symptoms of a complete transverse lesion at the level of the third dural vertebra. Dr. Manges located the bullet with the X-rays. He developed a fever, due it was thought to cystitis. He died in a few days. The necropsy showed the bullet in the interior of the spinal cord. The cord was virtually destroyed at this level and the bullet could not be seen where the dura was opened. It could only be seen when the cord was incised. Dr. Da Costa exhibited the specimen and stated that it was no wonder that the bullet was not discovered by the surgeon who performed laminectomy.

## LOCALIZATION OF FOREIGN BODIES IN SKULL AND SPINAL COLUMN.

DR. W. F. MANGES spoke as follows:

The apparatus, used to determine the location of the bullet in each of the two cases reported by Dr. Da Costa, is a modification of the Mackenzie Davidson cross thread localizer. It was devised by the Roentgen Mfg. Co. of Philadelphia, and is a detachable part of the tube carriage of their radiographic table.

All parts of the tube carriage are accurately graduated, and to the base of the tube holder are attached two spirit levels, so that it is possible to manipulate the X-ray tube in a definite and most precise manner.

The localizer has four adjustable rods, three of which are used to bring the localizer in a definite relation to the patient, and the fourth, to point to the exact location of the foreign body in relation to the localizer. There is a cross bar deeply notched at intervals corresponding to graduations on the cross bar of the tube carriage.

A clamp to hold the sensitive plate in relation to the tube carriage is attached to the edge of the table, and a shadowgraph of this clamp makes it possible to bring the developed plate back to the position it occupied at the time of exposure.

The relations, then, between the X-ray tube, the localizer, the patient, and the sensitive plate, are definite and can be manipulated with mechanical accuracy at will, and regained with equal precision after the exposures are made.

The technique of localization by this method is briefly this: The position of the bullet, or, other foreign body, is first approximately determined by means of the fluoroscope, or by making a skiagraph or two.

A sensitive plate is then put on the table and held by the clamp above mentioned. The patient is placed on the table so that the region containing the foreign body will be in the field of radiation, and that the desirable field of surgical operation will be directed towards the X-ray tube.

The localizer is then attached to the tube carriage; the carriage brought to position, and lowered so that the localizer approaches near the skin surface; the three adjustable pointers are made to touch the surface of the body at convenient spots, and in this position they are firmly fixed; these spots are made indellible with silver nitrate; all readings of the tube carriage and the spirit level are carefully noted. The localizer is then removed; the focus point of the X-ray tube (the source of light) is brought to a position which exactly corresponds to the position of one of the deep notches on the cross bar of the localizer, when it was in position; an exposure of but few seconds is made; the focus point of the tube is then made to correspond with the other deep notch on the cross bar of the localizer, and a second short exposure is made on the same sensitive plate.

The patient is removed, and the plate is developed. On the plate is then found two images, or shadows, of the foreign body and shadows of the two arms of the clamp which held the plate. When the plate has become thoroughly dry a piece of thin white paper is pasted as its corners to the film on the plate, and tracings of the several shadows are made. The plate with the tracings attached is then placed on the radiographic table in its original position with relation to the tube carriage and localizer; the tube carriage and localizer are also made to occupy their original posi-

tion, so that the two deep notches on the cross bar of the localizer assume the exact positions of the focus point of the X-ray tube at the time of exposure. A thread with a weight attached to one end is passed through one deep notch, and the weight end placed on the centre of the shadow made with the tube in that position, and a second similar thread is directed from the other notch to its corresponding shadow of the bullet. The point at which the threads, cross is the location of the bullet in its relation to the localizer.

The fourth adjustable rod of the localizer is then placed in position so that its point touches the crossing of the threads, in which position it is fixed, except in the direction of its long axis and superficial to the location of the cross threads. At the time of operation for removal the localizer is sterilized, and the radiographer observes the rules of surgical cleanliness so that he may adjust the localizer to the patient.

The three fixed points of the localizer are placed on their respective marks on the patient, and then the fourth rod will point in the exact direction of the bullet and at the same time give the exact depth from that point of the surface which it touches.

If necessary, at intervals during the operation the localizer may be reapplied to determine the depth of the wound and bullet.

Dr. Manges claimed no part in the designing of the apparatus, except the valuable addition of the spirit levels to the tube carriage, but he believed that the idea of sterilizing the apparatus and taking it to the operating table originated in the X-ray department of Jefferson Hospital, and that it was first put into practice in one of Dr. Da Costa's clinics during the winter of 1906–7. They had had its efficiency tested in five cases, in all of which the results have been most satisfactory, one of the cases having been determined on the postmortem table.

## NAILING A RECENT INTRACAPSULAR FRACTURE OF THE FEMUR.

Dr. G. G. Davis said that a couple of years ago he showed a case before the Academy in which he had fastened the fragments together with a steel screw, which was allowed to remain in for approximately four weeks. He considers it an interesting question as to whether or not to operate in cases of recent fracture. He believes that the case he refers to was the first to be reported,

and he advocated that method of procedure, that is, operative treatment in a recent intracapsular fracture. He considers the question as to the propriety of operative interference now lies in our estimate of the value of conservative measures. There are two ways of treating intracapsular fractures which have proven very successful; one, in which there is longitudinal traction together with lateral traction; the other is in the position of forced abduction. The question hinges upon the desirability of introducing foreign bodies into these bones on account of the danger of sepsis. He said that Dr. Da Costa would recall a case which he had him see several years ago, where there were beautiful symptoms of active sepsis, evidently caused by steel pins driven into an old ununited fracture, and since then Dr. Davis has had other cases in which it has been desirable to remove the pins. In one case where he tried using ivory pins, these pins broke and therefore in some of his recent cases, instead of using pins or screws to fix the fragments he has resorted to placing the limb in very marked abduction in plaster-of-Paris. Most of his cases have been those of ununited intracapsular fracture, but the union has been so prompt that he is growing sceptical regarding the necessity of using pins or other means of fixation by foreign bodies in these cases of intracapsular fracture. In justice, however, he states that he has seen one case in which this method of abduction was tried in a recent fracture but union did not occur.

Dr. H. Augustus Wilson said with regard to the disadvantage of driving the spike through the head of the acetabulum, that he considered that this was a proper mechanical procedure, for if the point of the spike went simply into the head it would have little opportunity of holding the head of the femur at the point of fracture. In one of his own cases he also drove the nail through the head into the acetabulum, and yet in two years' time there was perfect bony union; there was some restraint, however, to rotation, abduction and adduction, in which positions the point of the spike in the cavity in the acetabulum prevented these functions. Flexion was unimpaired. It seemed as though there were strong indications for the removal of the nail, but the patient was so well satisfied with the firm union that she declined to have the nail removed. The kind of nail used is of great interest. Nicolaysen drove in a steel nail, making no skin incision

and without anesthesia, driving the nail into position through the skin, leaving the head outside. In 21 cases he removed the nail in three weeks' time and he states that in every case the nail was found loose. Since that time large numbers of various materials have been used and in all cases where steel nails have been used the nails have had to be withdrawn. Being impressed with the fact that the nails were always found loose Dr. Wilson resorted to a method of barbing the nails; he has coin silver nails prepared in such a way as to make their entrance easy and their removal difficult. In one case this was found of decided advantage in that it held the nail fixedly in position and an X-ray taken two years after the insertion of the nail showed it in the original position. this method also got rid of the objection of drilling beforehand.

With regard to the old idea that old ununited fractures must have the edges freshened before they will unite, Dr. Wilson stated that in the January, 1908, number of the *American Journal of Orthopedic Surgery* he will make a report based upon the 35 cases on record. Comparatively few had the edges freshened, yet union almost invariably occurred. He believes that Dr. Da Costa is the first to resort to nailing a recent intracapsular fracture, as in all other cases reported considerable time had elapsed between the time of injury and that of operation.

Dr. Robert G. Le Conte wanted to know what practical value the nail could have if, as stated, it became loose a few weeks after its introduction. He thought its use might in a way explain the treatment of Bier for delayed union, viz.: that it produces enough irriation and exudation of blood around the fracture as to be the cause of the union, and that the success of the operation depends on this, and not the fixation of the fragments by the nail.

Dr. Oscar H. Allis said that the loosening of the nails was due to a certain inflammatory process by which they are absorbed, and that a nail as well as a screw acts as a foreign body. He believes that he was the first to put in an ordinary carpenter's screw in a fracture, and with only one exception has he ever had to search for the screw. After leaving it in for about six weeks it is almost ready to be picked out with the finger. In one case of fracture of the femur between the junction of the middle and upper third he turned the patient on the belly and cut right down on the posterior aspect of the thigh, and in that

way he had absolutely perfect drainage. In this case, when he was ready to take out the screw, he found the wound entirely closed, and he believes that if the patient is still living she still carries the screw with her. Dr. Allis believes that in some instances the nail or screw acts as a dentist's plug in a tooth.

Dr. Allis stated that the cancellous structure of the head of the bone is very much firmer and closer than in other parts. He believes oftentimes the good done by the nail or screw is in the presence of a foreign body.

## RECONSTRUCTIVE ENDOANEURYSMORRHAPHY.

Dr. Francis T. Stewart reported the case of I. C., colored, laborer, aged 36, who was admitted to the Pennsylvania Hospital June 1, 1907, in the service of Dr. Le Conte, who assisted in the operation. Nine years ago he acquired syphilis, but otherwise has been in good health. About four months before admission he developed a painful swelling in the right popliteal space. He had received no injury, but just before this time he had slept, on one occasion, with the affected leg hanging over the edge of his bed. Examination revealed a swelling about 4 inches long and 2 inches wide in the right popliteal space, giving all the intrinsic signs of an aneurysm. The knee was slightly flexed, the tibial vessels pulseless, and the leg free from swelling but the seat of severe pain. General examination revealed nothing abnormal except slight atheroma of the arteries. After exsanguinating the limb and applying an Esmarch band the swelling was exposed by a longtitudinal incision; the internal popliteal nerve, which was stretched over the sac, drawn to one side; and the sac opened. The aneurysm contained a large quantity of clot, which was soft and black in the middle, and white, tough and cribiform on the walls. The aneurysm had grown at the expense of the postero-internal wall of the artery, and the antero-external half being represented by a groove two inches long. A catheter was placed in this groove and the walls of the aneurysm approximated above it with catgut sutures, the catheter being removed before the last stitches were tied. One small collateral opening in the sac also was sutured. The sac was then obliterated by approximating its walls as described by Matas and the skin sutured without drainage. Immediately after the operation feeble pulsation could be felt in both tibial vessels, which became

stronger with the lapse of time. There was no bleeding during or after the operation. The leg was dressed on the twelfth day, the stitches removed, and healing found to be complete. The patient could extend and use his limb as freely as before the development of the aneurysm, but complained of the same severe pain as before the operation. Some weeks after leaving the hospital he returned with a lacerated hand. Because of the pain a splint had been applied to the leg at another hospital and this had caused ulceration near the heel; otherwise the leg was in the same condition as at the time of discharge.

That the Matas obliterative operation is superior to all other forms of treatment in cases in which it is applicable seems, at least in this country, to be generally admitted. The only possible disadvantage, as compared with extirpation, of which we can think is that in cases in which the nerves are encompassed by inflammatory tissue or incorporated in the sac wall the motor, sensory, or trophic symptoms may not be relieved. There is doubt, however, in the minds of many surgeons as to the advisability of the reconstructive operation. Excluding secondary hemorrhage, which in the absence of sepsis need not be feared, there are two reasons for this, viz., thrombosis at the seat of operation and recurrence of the aneurysm. Occlusion of the newly made vessel by thrombosis has probably followed most of the reconstructive operations. In our case the pulse in the leg reappeared immediately after the operation and persisted. It is possible that, although the first pulsations in the tibial vessels were due to blood flowing through the repaired artery, this soon became occluded, and that the pulse persisted because of the development of a collateral circulation, aided by the removal of the pressure of the aneurysm from some of the collateral vessels. With, however, the application of the principles of modern vessel suture, *i.e.*, fine needles, fine threads, close sutures, and the minimum of trauma, thrombotic occlusion should be less frequent. If it does occur, it may do so slowly enough to allow an efficient collateral circulation to form, but even though it occurs immediately, the same result would be obtained as in obliterative endoaneurysmorrhaphy. Recurrence of the aneurysm is the strongest objection to the reconstructive operation, as it has occurred twice in 16 cases. These figures do not include arteriorrhaphy for recent aneurysms following wounds of healthy arteries, in which there

is no question as to the best treatment. They do, however, include the Matas restorative operations, as there is no essential difference between these and those of the reconstructive variety, except the size of the opening and consequently the number of sutures applied. As Binnie has pointed out, the aneurysm which Matas calls fusiform is in reality a sacculated aneurysm whose mouth has extended for some distance along one side of the artery. No doubt with improved technic and larger statistics recurrence will be less frequent. A recurrence of course leaves the patient no worse than he was before and may be dealt with by any of the methods applicable to a primary aneurysm. As gangrene is inevitable in a certain proportion of all operations interrupting the circulation in the main artery of a limb, we believe that, despite the possibility of recurrence, the reconstructive operation should be encouraged.

Dr. J. Chalmers Da Costa said that he had never done the reconstructive operation for aneurysm, but that he had done the obliterative, and in his case had found it impossible to use very fine needles. In this case there was a thick, tense sac and large needles had to be used. He obliterated the sac but could not completely close it, and had to pack gauze down upon it, and the result was a large cicatricial mass in the popliteal space which caused partial flexion of the leg. A number of months passed before it was possible to get the leg straight again. He believes the old Hunterian ligation still has a place.

## RUPTURE OF THE LUNG WITHOUT COSTAL INJURY.

Dr. R. G. Le Conte read a paper with the above title, for which see page 383.

Dr. Oscar H. Allis considered that the mechanism of the lung might be explained as in the mechanism of a lacerated intestine; such laceration depends on the condition of the intestine at the time of injury, whether full or not, and if laceration occurs it will be at the point where the mesentery is shortest. With regard to the lung, this organ is never seen at postmortem in its normal condition; it is heavier under ordinary circumstances than at postmortem. Hence, it seems there might be enough weight to tear it entirely away. Dr. Allis considers this adds another argument with regard to the mechanism of that lesion.

Dr. Astley P. C. Ashhurst said that it might be of interest

to know that about one-sixth of the cases of rupture of the lung without injury of the thoracic parietes have been reported by Philadelphians. In 1871 (Trans. Path. Soc., Phila.) his father had collected 20 such cases, 14 of which are not included among the 20 instances of this injury recently analyzed by Schwartz and Dreyfus [Revue de Chir., 1907]. If these tables be combined, and there be added to them the cases reported by Le Conte, and by Stewart, as well as a second case reported in 1894 by Prof. Ashhurst, there would be 47 cases in all, 33 of the patients recovering. Dr. Ashhurst does not believe the mortality rate has been altered in recent cases, as practically no changes have been introduced in the treatment. He said that there had been a number of cases of traumatic rupture of the diaphragm reported, where laparotomy was done, but that in these cases the mortality rate was high. Mortality after a thoracotomy, however, he states is very much less than after abdominal section for all forms of diaphragmatic hernia, and thoracotomy is also a much easier operation, especially for stab wounds and traumatic rupture of the diaphragm.

## DOUBLE-FACED SURGICAL ADHESIVE PLASTER.

Dr. Charles Lester Leonard presented samples of a double-faced adhesive plaster. This plaster has a double coating. On one side zinc oxide and on the other plain rubber adhesive. Thus the plaster can be applied directly to the skin and covered with a bandage or can be made to hold the initial end of the bandage in place. It can also be utilized to hold compresses and splints in place insuring absolute fixation in their original position. Applied in strips between the layers of bandage it adheres to both fixing them intimately together preventing any displacement and increasing their rigidity, and consequently the support obtained for the parts. It is very serviceable, neat and effective as a method of fixing the loose end of any bandage, a transverse strip, the width of the bandage in length, beneath the end holding it firmly and neatly in position, a very desirable result, especially in dressings on the head and face. Local dressings, as in boils, abscesses or ulcers, can be held in place by strips, concealed beneath the final layer of gauze.

Other application of this form of surgical adhesive plaster will readily suggest themselves to the surgeon when employing

it in practical work, where it will be found particularly useful in fixing dressings, pads or splints to the skin.

Its only use has heretofore been in the retention of wigs and toupes and has not been utilized in surgical dressings or previously made in a form suitable for surgical application.

It is now manufactured in five yard rolls one inch, one-half and one-fourth inch wide, and can be furnished, if desired, in sterile packages.

# BOOK REVIEWS

THE TREATMENT OF FRACTURES. By CHARLES L. SCUDDER, M.D., Surgeon to the Massachusetts General Hospital; Lecturer on Surgery in the Harvard University Medical School. Sixth edition, thoroughly revised and enlarged, with 856 illustrations. Philadelphia and London: W. B. Saunders Company, 1907.

Six editions of this work attest the popularity the former ones have met with. In the present one the author has amplified the text with new illustrations and extracts from the most recent contemporary literature.

Dr. Scudder advocates the more general employment of anesthesia in the examination and the initial treatment of fractures, especially of those near or involving joints, and this in conjunction with the accurate knowledge of conditions derivable from the use of the Röntgen ray tends to a greater simplicity of treatment and the abandonment of many of the older and more complicated mechanical devices; we notice that the book is not encumbered with many, at best, archaic and unnecessary appliances.

Theories of treatment are not discussed, but the thought and anatomical knowledge of the examiner is brought to bear directly on the actual conditions which are found in each individual case of fracture. Mechanical simplicity is always the thing to be attained. We concur most emphatically in the author's plea for the frequent inspection of fractures, a fresh application of the dressing and re-adaptation of the splints; this point can never be too forcibly emphasized.

The newer nomenclature of " closed " and " open " fractures, instead of the misleading and frequently misused terms, " simple " and " compound " fractures, is used. The more uncommon fractures are not considered. Surgical intervention in the case of certain fractures is discussed at some length in this edition, and a few operative procedures have been described. Remote results following trauma to the head have also received deserved attention.

The author has developed certain chapters and introduced new ones devoted to obstetrical fractures of the new-born, to fractures of the zygoma, of the malar bone, of the superior maxilla, of the head and neck of the radius, of the neck of the femur, and to the carpal scaphoid; to unreduced dislocations of the elbow, to acromio-clavicular dislocations, to pathological fractures, to old fractures of the radius, and to Volkmann's contracture.

The work takes up systematically the regions and their bones. In addition to this ordinary classification, there are introduced sections on anatomical facts regarding the epiphyses; gunshot fractures and their treatment; the Röntgen ray and its relation to fractures; the employment of plaster of Paris; the ambulatory treatment of fractures; and notes of the more common dislocations.

JAMES TAFT PILCHER.

# CORRESPONDENCE.

## THE BOTTLE OPERATION FOR HYDROCELE.

EDITOR ANNALS OF SURGERY:

In the December, 1907, number of the ANNALS OF SURGERY Dr. E. Wyllys Andrews describes a new method for the radical cure of hydrocele, which he calls the "Bottle operation." This operation was described by Doyen in 1895, though conceived in 1890; he required but three to five minutes for its performance. (Archiv. Prov. de Chir., 1895, vol. 4, p. 706.)

In India it is known as Pratt's operation. (Tandau, Brit. M. J., Apr. 22, 1905, p. 882.) His description is found in the *Indian Medical Gazette,* August, 1898, page 287. It was reserved for hydroceles not larger than a cocoanut—in the enormous ones sometimes seen he thought it best to first remove part of the sac; a year later, however (*Indian Medical Gazette*, April, 1899, page 116), as a result of an experience with it in 128 cases, he withdrew this restriction, finding removal of the sac unnecessary in even the largest hydroceles—the size of a football.

Longuet (Presse Medicale, Paris, Oct. 31, 1900, p. 309) describes what he regards as a modification of the operation, the time for its performance being reduced to one minute and the patient being about his usual duties the next day! With a little practice he says "C'est un escamotage."

The following are further references to this operation:


Winkelman. Centr. f. Chir. No. 44, 1898, vol. 25, p. 1092.
Williams. Polyclinique (Paris), Mch. 15, 1905, p. 84.
Niblock. Indian Med. Gaz. Mch. 1902, p. 121.
Gaynes-Doyle. Brit. Med. J., Jany. 28, 1905, p. 184.
Legue. Rev. de Chir. 1899, p. 601.
Chandéze. Archiv. de Med. et de Pharm. Milit. 1903, p. 193.
Handé. Paris Thesis, 1900.
Gâmbier. Paris Thesis, 1901.
B. A. Heymann. Ein Beitrag zur Radikaloperation der Hydrozele, 1904. Griefswald.



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EDITOR ANNALS OF SURGERY:

I am greatly interested and gratified to learn from Dr. Vale's references that Dr. Pratt of India anticipated me by eight and a half years in the publication of a stitchless method for eversion of the sac in hydrocele. I seldom see the East Indian journals and it seems to me that too little interest and recognition has been accorded the original work of Indian and Australian surgeons in Europe and America. I should like to see the method called "Pratt's operation" if it is to have a name at all.

Of course the French surgeons first devised and published the eversion method (method 3 in my paper). I should never see the fairness of calling this technique Winkelmann's operation, as is done in Germany, unless credit for original work is to be circumscribed by boundaries of race and language. It will be seen from the bibliography given above that Winkelmann is several years behind the French in date of publication.

He had not reached the stage of discarding stitches (which constitutes the "bottle operation") but advises that the slit in the sac be *"so weit durch eine Knapfnaht verkleinert . . . dass eine Wiederdurchtritt nicht mehr moglich ist."* (Centr. f. Chir., 1898, Bd. xxv, s. 1092.)

Since writing the paper on the "bottle operation" last July I have had a number of additional cases. My own experience, as well as that of Dr. Bevan and several Chicago operators, is that it is a surprisingly quick, easy and bloodless method of cure, well suited to local anesthesia.

E. WYLLYS ANDREWS.

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